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The Paris Conference of the International Standards Association

by

John Gaillard, *Mechanical Engineer*
American Standards Association

Report to the American Standards Association on the May, 1930, Paris conference, delivered at the meeting of the Standards Council, September 11, 1930

The ISA is a federation of the national standardizing bodies of 18 countries:

Austria	Germany	Poland
Belgium	Holland	Roumania
Czechoslovakia	Hungary	Russia
Denmark	Italy	Sweden
Finland	Japan	Switzerland
France	Norway	United States

The purpose of the ISA is the systematic exchange of information on standardization work accomplished or in course of development in the different countries, and the promotion of uniformity among the various national standards, wherever this appears to be feasible and desirable.

The basis for the ISA was laid at an international conference held in New York in 1926. The ASA joined the ISA in the fall of 1929 upon unanimous decision of its Board of Directors. The central office of the ISA is located in Zurich, Switzerland, but will be transferred in the near future to Basle, Switzerland (see under "Plenary Assembly").

The conferences held in Paris, May, 1930, were:

1. Technical conferences
2. Conference of the secretaries of the National Bodies
3. Meeting of the ISA Council
4. Plenary Assembly of delegates of the Member-Bodies

Technical conferences were held on subjects taken up by a technical committee appointed under ISA auspices, or proposed to be taken up by such a committee. Subjects:

Paper sizes (*see page 4*)
Technical drawings (*see page 5*)
Twist drills and other small tools (*see page 6*)
Test pressures for the acceptance of new stationary steam boilers (*see page 6*)
Wrench openings (widths across flats of bolt heads and nuts) (*see page 7*)
Rivets (*see page 8*)
Coal (*see page 9*)
Petroleum products (*see page 9*)
Traffic signals (*see page 10*)
Fluid meters (*see page 10*)

No American member has as yet been appointed on any of the ISA technical committees. However, exchange of information on a number of subjects has taken place since 1926, between foreign and American groups, through the ASA office and the central office of the ISA. Also, as will appear later (see under "Petroleum Products"), the secretariat for one project to be dealt with under ISA auspices was assigned to the United States.

In cases where no work on the subject had as yet been started, the conference had an informatory character, its primary purpose being to decide whether the ISA Council should be requested to appoint a technical committee on the subject concerned, and if so, what the general scope of the work should be.

The conference of secretaries of the national bodies was held to discuss several aspects of the international work, such as method of cooperation, the extent to which new projects could be taken up without overloading the program, promotion of the ISA work, etc.

The ISA Council must meet each year, according to the ISA Bylaws. One of its tasks is to take a decision on the recommendations to set up new technical committees, made by the national bodies.

The Plenary Assembly meets, as a rule, once in three years. The particular items dealt with in the Paris meeting will be referred to in detail later.

I attended all of the meetings except that of the ISA Council. Invitations by the President of the ISA to attend the Council meeting had been restricted to the presidents of national

bodies attending the Paris conferences (Denmark and Finland). The technical conferences on "Traffic signals" and on "Fluid meters" could be attended only in part. The former was held simultaneously with the conference on "Petroleum products," while the latter coincided for the greater part with a session devoted to the editing of the resolutions adopted at the previous conferences.

TECHNICAL CONFERENCES

Paper Sizes

(ISA Technical Committee No. 6.
Secretariat: Germany)

A national standard system of paper sizes was adopted some years ago in Germany and taken over by ten other countries: Austria, Belgium, Czechoslovakia, Finland, Holland, Hungary, Norway, Poland, Russia, and Switzerland.

The system is based on two principles:

1

The ratio between width and length of each sheet is $1:\sqrt{2}$ (about 1:1.41). This is the only ratio which gives all sheets the same shape, assuming that each sheet is halved to obtain the next smaller one.

2

The basic sheet from which all sizes are derived has an area of one square meter, its dimensions being 841 × 1189 mm. This sheet size is designated by A-0, the next smaller size by A-1, etc. The A-series is to be used whenever possible, while B, C, and D-series, systematically related to the A-series, have been standardized for applications where A-sizes are not suitable (envelopes for folded A-sizes, etc.).

Significance of A-sizes

The Dutch national standardizing body had raised the question whether the A-sizes applied to rough (or untrimmed), or to trimmed sheets. It claimed that rough sheet sizes were more important, as they concern directly the paper manufacturing equipment. The German body held that the most important factor was the sizes of trimmed sheets, or of pamphlets, magazines, books, etc.; that is, the finished product. This controls the dimensions of filing equipment, the distance between shelves in bookcases, etc., and also the facility of correctly stacking printed matter.

The large majority of the national bodies represented supported the German standpoint.

The result of the discussions was that each country should establish its own tolerances on the A-sizes, these tolerances to be kept as small as possible so as to bring the untrimmed and the trimmed sizes closely together.

Letterheads

Efforts to standardize the business letterhead, comprising the location of such data concerning the sender, as his mail address, cable address, telephone number, reference symbol, etc., and the location of the address of the addressee, have been undertaken in several countries. The Austrians have placed all data referring to the sender at the bottom of the sheet, as this space cannot be used for typewritten text. The Germans have set up national standards for a business letterhead, a business memorandum (half size of letterhead), and a business postcard. They are now developing a standard "commercial" card, mentioning the product or service held available by a business firm. Such cards are meant to be filed in the card index system of the addressee (reference department, purchasing agent, etc.).

A sample book containing 100 samples of letterheads, etc., selected from work submitted in a printers' competition in Germany, was placed at the disposal of the delegates. (A copy of this book may be obtained as a loan from the ASA Information Service, upon application by those interested.)

The question was raised whether the address (of the addressee) should be written on the left or the right hand side of the letter. (This also concerns the location of a "vertical" window in an envelope, see page 5.) Five countries preferred the left hand, and three the right hand location. Germany belonged to the former, the tendency in that country being to eliminate from business letters all indentations, subdivision of the text into paragraphs, and other factors calling for diversity in the shifting of the typewriter carriage. Also, this elimination permits the maximum amount of text on a given sheet. To be consistent, the address must then also be written at the left hand side, without indentation. Those favoring location of the address on the right hand side gave as their argument that the address was thus more easily visible on letter copies filed in folders.

A French memorandum was submitted suggesting that one letter of the business name on the letterhead be underscored (in printing) to facilitate filing by the addressee. The name of the ASA would be given as: "American *S*tandards Association" to indicate that it should be filed under *S*(tandards).

It was recommended that this proposal, and the standardization of letterheads, more particularly the location of the address (of the addressee), be studied by the national bodies.

Envelopes with "vertical" window

A "vertical" window is a window whose largest dimension is at right angles to the largest dimension of the envelope.

Envelopes with a "horizontal" window are admitted in international correspondence, but all efforts to have the "vertical" window nationally approved by postal authorities have so far failed. In Austria and Germany, the postal authorities are now willing to consider its approval as soon as international agreement on the appearance of this kind of envelope has been reached.

The "vertical" window is advocated because it permits the Continental standard letterhead (A-4 size, 210 × 297 mm) to be folded in the most natural way, once crosswise and once lengthwise, to position the address properly behind the window. A "horizontal" window requires "fancy" folding, inconsistent with maximum speed of mailing letters.

An objection against the use of a "vertical" window was based on the fact that it would require a 90 degree turn to read the address in sorting out mail at the post office. This brought up the question to what extent (horizontal) window envelopes are used as compared to plain ones. It was stated that in Germany 21 per cent of all envelopes used were window envelopes: 60 per cent of all German letters are business letters and 35 per cent of these are mailed in window envelopes. In France, the percentage of window envelopes was said to be only 10 per cent of all letters mailed.

A Dutch delegate suggested that envelopes with a "vertical" window have their flap on the short side. The window would then formally become a "horizontal" one again and be acceptable in international correspondence. This suggestion was criticized because it would become more difficult to introduce the letter.

The conference recommended that the national bodies study the question of "vertical" window envelopes, both from the viewpoint of postal service and from the user's viewpoint. The delegates were invited to submit to the secretariat (German body) their replies to the following three questions:

1

Has any approach to the postal authorities in your country been made with regard to the use of envelopes with a "vertical" window, and, if so, by whom was this approach made?

2

What are the intentions of the postal authorities in your country regarding the introduction of envelopes with "vertical" window? Will the latter be possibly approved for domestic use in your country?

3

Are you in favor of submitting a request to the International Postal Union to be signed by the representatives of all countries concerned, or would you prefer to have separate steps taken in each country?

(The U. S. Postmaster General's office was addressed in regard to this some time ago by the ASA office and found to be opposed to the use of envelopes with a "vertical" window, on the basis of the existing regulations. This tentatively answers questions 1 and 2. With regard to question 3, the ASA will make a further investigation.)

Punch holes for filing purposes

A canvass made among the several national bodies had shown that the majority appeared to favor a center to center distance of 80 mm (about $3^1/_8$ inches) and a hole diameter of 5 to 5.5 mm (about $^3/_{16}$ to $^7/_{32}$ inch).

Drawings

(Proposed secretariat divided between Austria, France, and Switzerland)

There is a good deal of uniformity between Continental national standards on technical drawings and drafting room practice. For example, sizes of drawings are the same in those countries where the standard system of paper sizes has been adopted (see under "Paper sizes").

The conference decided to recommend that a number of subjects, classified in three groups on the basis of their urgency, be taken up under ISA auspices, as follows:

Group 1

1. Sizes of drawings, and scales of reduction and enlargement
2. Finish marks
3. Indication of tolerances and fits
4. Symbols for bolts and rivets
5. Representation of welds
6. Property and copyright stamps

Group 2

1. Arrangement of views and sections
2. Representation of screw threads
3. Cross-hatching of sections
4. Section lines and planes, and methods of indicating dimensions
5. Tapers and slopes (also the taper of shafting keys)
6. Symbols for springs, gears, etc.

Group 3

1. Lettering
2. Type, thickness, and use of lines
3. Method of folding drawings
4. Designation of different kinds of drawings
5. Graphic presentation
6. Designations of materials, and their abbreviations
7. Model working drawing

I reported to the conference on developments in the ASA technical committee on "Drawings and drafting room practice."

An interesting question is that of the method of projection. All continental countries, with the exception of Holland, use first angle projection. In Holland this method was originally made a national standard, but shortly afterward a change was made to the third angle method (called "American method," in Europe). The Dutch secretary and the writer were asked to submit a joint report on this item. A memorandum on American practice has been sent the Dutch body, as part of such report.

The Swiss body will take charge of the secretariat for Group 1, while the Austrian and French bodies will share the secretariat for Groups 2 and 3.

The national bodies were invited to state in which of the three groups they wish to cooperate.

Drills and Other Small Tools

The French body had proposed that the unification of standards for twist drills be taken up by the ISA technical committee. In Paris, it was decided that consideration should also be given to small tools other than drills, but not to machine tool elements.

It was recommended that work be started on several subjects, classified in two groups on the basis of their urgency, as follows:

Group 1

1. Twist drills
2. Machine tapers
3. Squares for tool shanks
4. Sections and nomenclature of cutting tools
5. General nomenclature of tools

Group 2

1. Threading tools
2. Reamers
3. Milling cutters

I reported on the latest developments in the work of the ASA technical committee B5 on "Small tools and machine tool elements," especially on the proposed standards for "Milling cutters" and "Cut and ground thread taps" (both approved since as American Standards) and on the series of "Sizes of twist drills," and "Machine tapers," still under consideration.

The French body was assigned the general secretariat for the international work, while the German body was invited to handle "Machine tapers," both metric and inch (Morse), and the Swiss body, "Sections and nomenclature of cutting tools."

The following subdivision of the subject "Twist drills" (Group 1, item 1) was tentatively adopted:

a. Short twist drills with cylindrical shank
b. Long twist drills with cylindrical shank
c. Twist drills with Morse taper
d. Long twist drills with square taper
e. Short twist drills with square taper
f. Twist drills with square taper for braces
g. Center drills

(a) Test Pressures for the Acceptance of New Stationary Steam Boilers. (b) Specifications for Boiler Plate

(ISA Technical Committee No. 2.
Secretariat: Czechoslovakia)

Test pressures

The secretariat (Czechoslovakia) had worked out a proposal for an internationally acceptable standard test pressure. This pressure is represented by the formula:

$$P = 1.3\ p + 3$$

in which P = test pressure in kg per sq cm
p = working pressure in kg per sq cm

Converted into English units, this formula becomes with close approximation

$$P = 1.3\ p + 43 \text{ (pressures in lb per sq in.)}$$

In opening the conference, the chairman, Prof. Doerfel, referred to the modern tendency in Continental practice of testing boilers, to lower the test pressure, and the reasons therefor. Until a few years ago the test pressure was primarily based on the tensile strength of the boiler plate material. It has been found in recent years that more consideration should be given to the yield point. The yield point value being considerably lower than the tensile strength, the amount by which the test pressure exceeds the working pressure affected the factor of safety of the boiler with regard to the yield point more than it did the factor of safety with regard to

the tensile strength. The stresses caused by testing might bring some parts of the boiler material close to, or even past the yield point, without reaching, however, the tensile strength. This explained, first, the reason why many boilers collapsed when being tested, and, second, why boilers sometimes exploded although they had passed the test in a satisfactory manner. A slight compensation in practice was caused by the fact that while the yield point of ordinary boiler plate material (mild steel) decreased with an increase in temperature, its tensile strength increased. In the case of nickel steel, it made little difference whether the tensile strength or the yield point were based on. However, this material was too expensive for ordinary boiler construction.

In the subsequent discussions it was stated that even in cases where boilers successfully withstood a relatively high test pressure, they were frequently damaged permanently by the formation of exceedingly fine cracks in the plates. These cracks started from the rivet holes and were invisible to the naked eye. The Hungarian delegate held that a test pressure 25 per cent in excess of the working pressure (p) was sufficient to determine whether or not the boiler was tight and that any increase in test pressure above 1.25 p would therefore only be harmful.

The discussions showed that France, Poland, and the U. S. (A.S.M.E. Boiler Code) had adopted a test pressure P = 1.5 p. Only Japan goes higher, namely, to P = 2 p, whereas Belgium, Germany, Holland, Hungary, Italy, Roumania, Sweden, and Switzerland supported the Czechoslovakian idea of changing, for boilers within the higher range of working pressures, to a lower test pressure. It appeared that several European countries had already adopted a test pressure close to that resulting from the formula proposed by the Czechoslovakian body.

The wish was expressed that the Japanese body reconsider the question with a view to determining whether the test pressure in its country could not be reduced at least to 1.5 p.

The questions of periodical inspection of boilers (place, conditions, time intervals), the delivery of a certificate, and the regulations for stamping, were also discussed. The conference decided that these matters had no great international importance and should be left to be dealt with by the national bodies concerned.

Specifications for boiler plate

The Czechoslovakian body had proposed, some time before the Paris conference, that specifications for boiler plate be also taken up under ISA auspices. The conference recommended that this subject be taken up by a subcommittee of ISA Technical Committee 11 on "Test pressures for boilers" whose work should be correlated with that of ISA Technical Committee 17 on "Iron and steel."

On April 25th, I attended a meeting of the A.S.M.E. Boiler Code Committee in order to submit the two above proposals for its information, to find out whether the B.C.C. considered American participation in the ISA work desirable. It appeared that the B.C.C. was not interested in having an American member appointed on the ISA Technical Committee, but would be glad to be kept informed about the progress of the international work. Also, the B.C.C. was quite prepared to furnish to the ISA committee information on developments in the U. S. (as it had already done a few years ago). I reported this to the conference, also giving certain data on American practice that appeared to be desired during the discussions.

Wrench Openings (Widths across Flats of Bolt Heads and Nuts)

(ISA Technical Committees 1b and 2b. Secretariat: Sweden)

The Swedish secretariat had submitted to the conference a proposal for an internationally acceptable standard, suggesting the establishment of two series of wrench openings (widths across flats), a "light" and a "heavy" one. The American standard sizes of rough and semi-finished bolt heads and nuts appeared to lie, generally speaking, between the corresponding sizes of the proposed "light" and "heavy" nuts.

The Swedish proposal, submitted to the national bodies shortly before the conference (I did not receive it until I was in Europe) was thoroughly discussed. In reply to a canvass made by the chairman as to whether the proposal appeared to be acceptable to industry in the several countries represented, I made the following statement, giving this as my personal opinion as there had been no time to lay the Swedish proposal before the ASA technical committee on "Bolt, nut and rivet proportions." I said that an American standard had been approved by the ASA in 1927, after several years of painstaking work by the technical committee concerned.[1] With a few changes, now under consideration, it had been found generally satisfactory both to manufacturers and consumers. Therefore, it did not seem likely that American industry would wish to consider at the present time such changes as proposed in the Swedish memorandum.

During the following discussions, one of the

[1] Tentative American Standard B 18b-1927 on "Wrench head bolts and nuts and wrench openings."

delegates used the term "U. S. Standard" sizes when referring to the sizes as now laid down in the American standard. The term "U. S. Standard" having been used in this country for the large bolt heads and nuts as originally proposed by William Sellers (superseded by the smaller sizes according to the American standard), I called the attention of the conference to this question of terminology in order to avoid confusion, such as has been caused sometimes in the U. S.

Mr. Hoenig (president ISA) seized this opportunity to recall the history of the development of the European standards for widths across flats as now adopted in several Continental countries. They were based on the standards adopted by the German body shortly after the war, in a period when there was not yet any considerable exchange of information on standardization work between the several countries. The Germans, assuming that the so-called "U. S. Standard" sizes were generally used in the U. S., had based their widths across flats on the old American series. However, in the U. S. only three per cent of American bolts and nuts were actually made to the "U. S. Standard" sizes. After the Americans had published in 1924 a draft standard proposing bolt heads and nuts considerably smaller than those according to the so-called "U. S. Standard," German experts went to the U. S. and conferred with the Americans. During the years that had elapsed, however, several other countries had followed the German standard so that the relatively large bolt heads and nuts had been widely introduced into Continental practice. Mr. Hoenig was of the opinion that Continental and American bolt head and nut sizes might have been identical—and smaller than the present Continental sizes—if no misunderstanding had occurred at the time regarding the term "U. S. Standard."

One delegate stated that any effort to establish an internationally acceptable series would have little effect if the U. S. and Great Britain did not see their way clear to join.

It was evident that the objections raised by the conference against the Swedish proposal were based on the fact that a change from the existing Continental standards would be difficult, rather than on technical objections against the proposed smaller sizes. Under these circumstances, I thought it would be useful to submit the following questions to the conference:

1

Do the small American sizes of heads and nuts, or sizes close to these, appear to be acceptable to the other delegates, considered from the *technical* point of view? (That is, leaving aside the difficulty of making a transition from the existing standard to a new standard, whatever that new standard may be.)

2

Are round millimeter sizes essential for a new series of wrench openings, in the opinion of the delegates?

Question 1 was self-explanatory. With regard to question 2, I explained that in cases where a tolerance had to be given on a nominal dimension (as in the case of widths across flats), strict adherence to a round size did not seem to be of essential importance. Therefore, would the European delegates object to the adoption, in an international series, of existing inch sizes, translated into millimeters, simply because these millimeter figures were not round ones?

The two questions, being laid before the conference by its chairman, were extensively discussed. With regard to question 1, all of the delegates with the exception of one (Switzerland) stated that there appeared to be no technical reasons why the American small heads and nuts would not be acceptable. If they were satisfactory for American use, as one delegate put it, they would be so for European use. The exception taken by the Swiss secretary was based on the attitude of some manufacturers in his country who objected to the reduced bearing area of the smaller heads and nuts.

Question 2 was unanimously answered to the effect that the European bodies would be willing to compromise, for the sake of international uniformity, on wrench openings (widths across flats) with nominal sizes expressed in fractions of millimeters, if necessary.

The conference did not take a decision with regard to the Swedish proposal, but recommended that the Swedish secretariat reconsider the problem again in the light of the discussions held at a conference and that it work out a new proposal embodying a single series of widths across flats to serve both for "light" and "heavy" heads and nuts.

Rivets

(ISA Technical Committee No. 7.
Secretariat: Holland)

The Dutch secretariat had circulated a proposal in May, 1930, too late for consideration by the American committee on "Bolt, nut and rivet proportions." It dealt with:

1. Method of measuring shank diameter
2. (*a*) Series of shank diameters (small rivets below 10 mm; large rivets 10 mm and upward)
   (*b*) Tolerances on diameters
3. Countersink angle of rivet heads

According to the proposal, rivets below 20 mm would be measured at a distance of 5 mm below the head of a rivet with straight shank, or below the base of the taper neck or countersunk head. For larger rivets, the proposed distance was 10 mm.

The discussion resulted in a consensus of opinion that a distance of 5 mm would be satisfactory for all sizes of rivets. As to series of diameters, the majority of the delegates agreed to recommend the following sizes:

Small rivets (in mm)

1.0 1.2 1.4 1.7 2.0 2.3 2.6 3.0 3.5
4.0 5.0 6.0 7.0 8.0 9.0

Large rivets (in mm)

10 13 16 19 22 25 28 31 34 37

The general opinion was that tolerances on rivet diameters below 10 mm did not call for international unification. In Germany, it had appeared to be impossible to standardize tolerances on holes for small rivets due to the variety of metals in which the holes are made, and the variety in methods of producing the holes (punching, drilling, etc.). Thence, there was no reason for trying to standardize tolerances on small rivets.

The proposed tolerances for rivets larger than 10 mm were the following:

Diameter	*Permissible variation in mm*	
Up to 16 mm, incl.	—0.1	+0.3
19 to 25 mm, incl.	—0.2	+0.4
Above 25 mm	—0.3	+0.5

These tolerances were considered by most of the delegates as being too ample. Smaller tolerances were being maintained in several countries and even then it was sometimes found difficult to fill the rivet holes. Discussion of the countersink angle of rivet heads brought out that wide variety existed in the combinations between angle, and type, size and use of the rivet. It was decided to let this item rest for the time being.

The general result of the conference was that the Dutch secretariat was invited to make a further study of the question of series of rivet diameters and the tolerances thereon.

Coal

(Proposed secretariat: Poland)

The Polish national body had circulated a document stressing the desirability of taking up, in an international manner, the question of classifying coal on the basis of grain size. At the Paris conference, the possibility of standardizing methods of sampling and analyzing coal, and of classifying of coal on the basis of its physical and chemical properties, was also discussed. It appeared that even the seemingly simplest subject of the three—grading on the basis of grain size—offered many difficulties in practice. There appeared to be seven different coal regions in Germany and five different regions in Belgium, each of which had its own method of size grading, and adhered very closely to it. Some work had already been done on the subject under the auspices of the New International Society for Testing Materials (N.I.S.T.M.), in cooperation with the German national body. Work undertaken under the auspices of the ISA should be coordinated with that going on under the auspices of the N.I.S.T.M. and the World Power Conference.

Before sailing, the writer had corresponded on this subject with the American Society for Testing Materials (A.S.T.M.) and Mr. A. C. Fieldner, Chairman, ASA technical committee on "Classification of Coals." Through the courtesy of the latter he was able to submit to the conference copies of his paper on "Classification of North American Coals" and of a symposium of papers read at a February, 1930, meeting of the American Institute of Mining and Metallurgical Engineers.

The conference unanimously recommended that the ISA Council appoint an ISA technical committee on the subject, the scope of the work to be: methods of sampling and analysis of coal, and classification of coal on the basis of size (size grading). Classification of coal on the basis of its physical and chemical properties was not included in the proposed scope as presenting too many difficulties. The French delegation formulated the wish that it would be possible to take this subject up at a later date.

Nomenclature and Methods of Test of Petroleum Products

(Proposed secretariat: United States)

The Russian national body had made the proposal that standardization of petroleum products be taken up under ISA auspices. This proposal, which was circulated by the ISA office among the national bodies, had been referred by the ASA to the American groups primarily interested in this matter, such as the American Petroleum Institute, the American Society for Testing Materials, the Bureau of Standards, and a number of oil companies. The consensus of the replies was that standardization

of petroleum products was not practical at the present time and that it would be necessary first to standardize methods of *testing* petroleum products. The American Society for Testing Materials indicated in its reply that international discussion of methods of test under the auspices of the ISA would be very desirable. As the sponsor body for the standardization work performed by the ASA technical committee on "Methods of testing petroleum products and lubricants," the American Society for Testing Materials furthermore indicated that it would welcome it if the secretariat for this international work would go to the United States. Cooperation between this ASA technical committee and British and German groups had already been going on for some time. In fact, representatives of the British Institute of Petroleum Technologists and of the German Society for Testing Materials had been appointed members of the ASA technical committee.

The ISA had been advised of the American standpoint by letter from the ASA office, before the Paris conference. Therefore, the latter had to deal with two proposals, one being the Russian proposal to take up quality specifications of petroleum products, and the other, the American proposal to take up nomenclature and methods of tests of petroleum products.

At the opening of the conference, the writer briefly explained the American standpoint. This was supported by the large majority of delegates. They favored the idea of taking up of work on methods of test and nomenclature and unanimously recommended that the American group be asked to take charge of the secretariat. As to quality specifications, the delegates of Austria, Hungary, Roumania, and Russia voiced the desire that these be also taken up. The Russian body would be willing to take the secretariat for that part of the work.

The general secretary of the ISA was requested to get in touch, for the purpose of cooperation, with international organizations that have already taken up this subject, such as the International Union of Applied Chemistry, the New International Association for Testing Materials, and the International Electrotechnical Commission (with regard to transformer oils).

Traffic Signals

The Dutch national body had proposed that the subject "Traffic Signals" be taken up under the auspices of the ISA. It had also submitted draft specifications for traffic signals to serve as a working basis for an internationally acceptable standard. This draft deviated in some respects from a similar proposal worked out by the Permanent Committee on Highway Traffic, of the League of Nations. The co-existence of the two proposals formed the main point of discussion at the conference. The majority of delegates were not in favor of the project being taken up under the auspices of the ISA, for the very reason that it was under consideration by the Permanent Committee. It was decided that the Dutch body would get in touch with the Permanent Committee to ascertain whether the matter should be taken up with the national bodies again.

Fluid Meters

A proposal by the French national body to hold an informal discussion of this subject with the idea that it might be taken up under ISA auspices had reached the ASA office late in April. This left no margin of time for correspondence with the A.S.M.E. Special Research Committee on Fluid Meters. However, I was able to take along, together with a copy of Part I of the Report of the Committee, a copy of the proposed revisions, and so was able to make a brief report to the conference on the status of the work in this country. The conference resulted in an unanimous and urgent recommendation that an ISA technical committee on "Standardization of the measurement of fluids through nozzles and orifices" be appointed at an early date. The German delegation submitted a document entitled "Rules for flow rating by means of uncalibrated nozzles and thin-plate orifices at speeds below that of sound." Attention was called to the report on investigations made by Dr. R. Witte, of I. G. Farbenindustrie, Ludwigshafen, Germany, with the idea that this might serve as a working basis for the new committee. Willingness to participate in the work was signified at the conference by the delegates of Belgium, France, Germany, Sweden, and Switzerland. The other national bodies would also be invited to take part.

It was also recommended that the French group tentatively take charge of the secretariat.

The countries represented at the conference were Belgium, France, Germany, Holland, Hungary, Italy, Sweden, Switzerland, and the U. S. (during part of the meeting). An additional number of copies of the German report has been requested by the ASA office and a translation of its contents will be made if desired for the benefit of the A.S.M.E. Special Research Committee on "Fluid Meters." A British expert, Mr. Hodgson, arrived after the meeting had adjourned and left a note making several recommendations.

OTHER MEETINGS

I

Conference of Secretaries

Among the items on the agenda of this conference figured the report of the general secretary, introduction of standards into practice, means of promoting international cooperation, etc. Memoranda on some of these subjects had been circulated before the conference by some of the national bodies. The German body and the ASA had made contributions to the subject "Introduction of Standards."

However, no discussion of any importance on these subjects took place because of lack of time. In fact, the procedure to be followed in handling technical work and the question of how meetings and conferences should be held so as to result in most rapid progress, took up practically all of the time available.

Some of the national bodies stated that, being bound to a certain budget and staff capacity, it was impossible for them to spend more time and money on international cooperation than they had done so far. They recommended, therefore, not to undertake, under ISA auspices, any further new projects at the present time, or at least to restrict their number. On the other hand, it was pointed out that refusal by the ISA of a request to have a project undertaken under its auspices might lead to the work being undertaken under the auspices of some other organization. This was undesirable from the standpoint of the national bodies.

In connection with this point, discussion took place on the financial aspect of taking up a new project, national or international. It was suggested that if a group expressed to its national body the desire to have a project taken up, it should at the same time supply that body with the necessary financial support or staff facilities to handle the new work. The Swedish secretary stated that matters were actually handled that way in his country. The Dutch secretary, however, observed that, most requests for standardization in Holland originating from consumer groups, such a plan was not practicable. It was finally agreed that care should be used in taking on new ISA projects in order to avoid overloading of the program.

Another question discussed was that of the intervals between meetings on technical subjects. So far, such meetings had been held sometimes with an interval of only a few months, and it was therefore recommended that they be restricted to two meetings a year. Their duration might then be somewhat longer than they usually had been up to the present time. The Swiss secretary recommended more frequent meetings in order to avoid too much handling of projects by correspondence, tending to slow the work down.

The invitation of the Austrian body to hold the next series of meetings in Vienna, on the occasion of its annual meeting, was unanimously accepted. The Vienna meetings, originally planned for the beginning of September, were shifted to the end of that month. The subject "Introduction of standards into practice" would be taken up again in Vienna and a whole day spent on it. Upon invitation of the Danish and Polish bodies, respectively, it was also tentatively decided that the 1931 spring conference of secretaries would be held in May in Copenhagen and the fall conference in Warsaw.

A recommendation was made that all secretaries use the standard paper sizes, if at all possible.

An interesting discussion took place on the question whether the international cooperation in standardization work should be promoted by more widely advertising the ISA as such. This proposal was objected to in principle by other delegates who were of the opinion that such propaganda would be logical only in countries that did not yet have a national standardizing body, or in countries where the national body had not yet joined the ISA. However, in all countries whose national bodies had joined the ISA, promotion of standardization work should be entirely under the flag of the national body concerned, and not under that of the ISA. For the same reason, a suggestion that standards, unified under procedure of the ISA, should be called "ISA standards," was opposed. In this connection, I stressed the fact that under its present constitution the ISA is not empowered to set up international standards, a point which had been especially emphasized when the ASA joined as a member body. The conclusion reached was that the central office of the ISA should place any material having for its purpose the promotion of international cooperation in standardization work under ISA auspices, at the disposition of the national bodies.

The question was raised whether national standards should be copyrighted. This subject was considered to call for thorough discussion and its discussion postponed because of lack of time.

II

Meeting of the ISA Council

This meeting was not attended by the writer for the reason stated above. However, the decisions taken at that meeting were dealt with at the Plenary Assembly held in the afternoon, for the purpose of their formal approval by the national bodies.

III

Plenary Assembly

Mr. Ulrich, President of the French National Body, AFNOR, presided at the meeting. After he had welcomed the delegates, Mr. C. Hoenig, President of the ISA, reported on the results of the Council meeting held in the morning.

The first ISA Council consisted of the president and one delegate each of the national bodies of Belgium, Czechoslovakia, France, Germany, Holland, and Sweden. Mr. Hoenig stated that he would go over, as he had done in the morning in the Council meeting, all of the articles of the ISA Constitution and bring up, with every article, any point that called for discussion. He welcomed the national bodies of Roumania and the U. S. as new members of the ISA and urged cooperation between the ISA and other bodies of international scope interested in some phase of standardization work. In this connection he mentioned the International Institute of Management, the League of Nations, the International Electrotechnical Commission, the New International Society for Testing Materials, the World Power Conference, the International Silk Federation, the International Illuminating Society, etc. He announced that Dr. Hellmich, Managing Director of the German body, had been invited by the ISA Council to represent the ISA at the World Power Conference to be held in Berlin, June, 1930.

The Plenary Assembly approved by acclamation the Council's recommendation to elect Sir Richard Glazebrook, Honorary President of the ISA, in recognition of the services he had rendered in bringing about the establishment of this body.

The question of rotation in office of the Council members had been a rather confused one as the ISA had been established in Prague in 1928 with the understanding that its foundation would be considered formally to date back to the 1926 conference in New York, while two of the national bodies (the American and the British) that had members on the Committee of Seven, did not join the ISA in 1928. However, a ready solution of the problem had been found through the courteous attitude of four of the national bodies who had voluntarily retired from membership in the Council, in order to make place for other countries, as follows: Belgium would retire on behalf of Italy, and Sweden on behalf of Denmark, as of January 1, 1930; while Germany would retire on behalf of the U. S., and Czechoslovakia on behalf of Russia, as of January 1, 1931.

I thanked the president of the ISA and the delegates of the national bodies for the friendly spirit in which they had received me at the Paris conferences as a representative of a new member-body of the ISA and expressed appreciation on behalf of the ASA to the German body for its friendly act toward our Association with regard to membership in the Council.

The general secretary having brought up the question of removing the ISA central office from Zurich, the Council had agreed to have the office go to Basle, Switzerland.

With regard to the ISA budget, the general secretary had mentioned in his report that this should be at least £2000 ($10,000) whereas the present budget was only £1600 ($8000). However, the Council recommended that dues should not be raised at the present time, most national bodies being under a heavy load. It suggested, however, that the national bodies be asked for voluntary contributions to increase the budget of $8000. This suggestion was approved by the Plenary Assembly.

It was decided that the budget of $8000 would apply to the calendar years 1930 and 1931, while Prof. List, Chairman of the Czechoslovakian body, would draft a new schedule of distributing the contributions. This would apply to the calendar year 1932, if approved by the Plenary Assembly.

The account for the year ending December 31, 1929, showed a deficit of £47, being the balance of the original deficit of £165 existing at the end of the London period of the temporary ISA office, part of which (£110) had been canceled by the B.E.S.A. The amount spent for the business period October 1, 1928, to December 31, 1929, was £2080. (The business year had been changed in the meantime from the period October 1 to September 30, to the calendar year.)

With regard to the Bylaws, only two changes were suggested, namely, a re-allotment of the contributions to be made by the national bodies, and authority for the Council to restrict the number of new technical committees. According to the present Bylaws, a technical committee must be set up if requested by three member-bodies. It was decided that these changes would be discussed at the next Plenary Assembly.

The President of the ISA announced that the Council had been requested to appoint fifteen new committees. However, upon proposal of several members of the Council, it has been decided to recommend to the Plenary Assembly that only five new committees be appointed at the present time, these committees to deal with the following subjects:

Cast Iron and Steel
Bronze and Brass
Coal
Petroleum Products
Drills and Other Small Tools

The meeting was concluded by brief reports

of the chairmen of national bodies in charge of secretariats of ISA technical committees.

IV

Reception and Banquet

On May 26, the delegates were received by the Paris Chamber of Commerce in its beautiful building, 27 Avenue de Friedland. The delegates were addressed by Mr. André Baudet, President of the Chamber of Commerce. Mr. Hoenig, President of the ISA, spoke a word of thanks.

After the conferences, a banquet at the Palais d'Orsay was offered the foreign delegates by the Association Francaise de Normalisation (AFNOR). The Assistant Secretary of Public Works of the French government—who was introduced by Mr. Ulrich, President of the AFNOR—presided, and addressed the delegates expressing his appreciation of standardization work and international cooperation in this field, adding his best wishes for its further success. An address by Mr. Hoenig, President of the ISA, followed, expressing thanks to the AFNOR on behalf of the foreign delegates.

In closing this report, I wish to express my appreciation for the great courtesy and assistance shown the foreign delegates by the officers and staff of the Association Francaise de Normalisation (AFNOR), in making arrangements for the various conferences and during their stay in Paris.

International Unification of Standard Fits[1]

by

John Gaillard,[2] *Mechanical Engineer*
American Standards Association

A Résumé of the Historical Background and Efforts to Unify Existing National Systems of Fits between Cylindrical Parts

Serial or mass production of machines and other objects requires standardization of the fits between their component parts. These parts must be interchangeable in order to permit ready assembly and replacement.

A highly developed industrial country cannot do without a national standard system of fits because many industries are closely interwoven, their particular products being assembled into one final product. In addition, national standardization of fits makes it possible to standardize, in a national way, tools and equipment, such as reamers, drill bushings, etc., required for the establishment of standard fits, and also of the gages required for controlling them.

In our machine age, with an international exchange of goods, the establishment of an internationally unified system of fits has become an important problem. Certain developments now taking place under the auspices of the International Standards Association are interesting enough to be brought to the attention of groups in this country, the more so as, since the fall of 1929, the industry of this country is represented on the ISA through the American Standards Association. This body approved in 1925 a Tentative American Standard on Tolerances, Allowances, and Gages for Metal Fits (B4a-1925) established by a technical committee appointed under its procedure and sponsored by the A.S.M.E.

At an international conference held in 1926 in New York, where the basis for the ISA was laid, a series of technical subjects was discussed in special meetings. In one of these,

[1] Preprinted from the October, 1930, issue of *Mechanical Engineering*, by permission of the American Society of Mechanical Engineers.

[2] For several years Mr. Gaillard has been closely associated with the national and international phases of standardization work in different branches of industry. He has made a special study of standard systems of fits, and obtained many of the data used in the present article during a recent trip to Europe. In May, 1930, he took, part in conferences held in Paris under the auspices of the International Standards Association (ISA), of which the ASA is a member. Later he visited the German national body, Deutscher Normenausschuss, in Berlin, and several individuals and organizations prominent in the German standardization movement.

the problem of fits between cylindrical parts was dealt with. Each delegate explained the status in his country and the consensus of opinion was that it seemed possible to smooth out the differences between the several national systems then in existence.

When, in 1928, the ISA was formally established at a meeting held in Prague, a technical committee on fits was appointed under its auspices to draft a proposed system of fits that would be acceptable to all countries concerned. It was explicitly stated that one of the conditions to be answered by the new system was that parts made in accordance with it should be interchangeable with those made in accordance with the existing national systems.

A sub-committee consisting of delegates of the national standardizing bodies in Czechoslovakia, France, Germany, Sweden, and Switzerland, was appointed to draft a proposal. The secretariat of the international work on fits was entrusted to the German body, Deutscher Normenausschuss. Between 1926 and 1928, this organization had performed much valuable preparatory work by systematically collecting data on all of the national standard systems in existence or in course of development, and by elaborating, on the basis of these data, comparative graphs in order to find out in how far the existing systems possessed identical features. Early in 1930 the sub-committee had elaborated a first proposal.

The proposal, which will be submitted to American industry by the American Standards Association, is largely based on the German national system of fits, the so-called DIN[3] fits. For this reason a brief review will be given of the history of the development of this system and of its introduction into practice in German industry, in the course of the last ten years.

Development of the German National System

In 1917, when German industry started a strong standardization movement, one of the first subjects assigned to a technical committee was that of fits between cylindrical parts. Up to 1917, great diversity had existed in fitting practice. Gages were made to reference temperatures of 0, 15, or 20 C (32, 59, or 68 F, respectively). Some organizations applied a unilateral system of tolerances, others a bilateral. The numerical values of allowances and tolerances differed from firm to firm, if not from department to department, in the same organization. Under these conditions, there was no question of systematic assembly between parts made in different plants, let alone of standardization, in a nation-wide way, of tools and gages.

The German national system of fits, started in 1917, was completed in 1920. The work had been started with fine-grade fits, that is, with a group of fits most commonly used in the mechanical industry as a whole. Precision-grade fits were then added, for the use of the machine-tool industry and of other work requiring fits of a more exacting nature than the fine-grade ones. Following this, medium-grade and coarse-grade fits were elaborated, the latter to comply, for example, with the wishes of the builders of railroad cars.

DIN Fits

The main features of the German system in its present form are as follows:[4]

The reference temperature for gages, etc., is 20 C (68 F), the same as in the American standard system.

Unilateral tolerances are used, i.e., the tolerance is measured in one direction only. Furthermore, the general reference or zero line from which all measurements are made is the nominal size of the part concerned. All of these features are also incorporated in the American standard system.

The German system was designed from the beginning so as to comprise both a basic-hole and a basic-shaft system. In the former, the basic size of the hole is kept constant for a certain series of fits, the difference in fit being obtained by varying the size of the mating shaft. In the basic-shaft system, on the contrary, the basic size of the shaft is kept the same for a certain series of fits, the size of the mating hole being varied to produce the desired fit.

Both systems were adopted side by side in the German standard, on the ground that it depends on the nature of the product, and on the manner in which it is manufactured, whether one or the other sub-system will prove to be the more advantageous from the combined technical and economical points of view. In fact, it cannot be said, in general, that either the basic-hole or the basic-shaft system is preferable. In many cases the question of which system should be chosen is a rather difficult one to answer, requiring careful weighing of a goodly number of correlated factors. Therefore, the Germans decided that the national standard ought to enable every manu-

[3] The symbol DIN, an abbreviation of Deutsche Industrie Norm, meaning German Industrial Standard, is now generally used in Germany for designating any object complying with a standard approved by the German national standardizing body, Duetscher Normenausschuss. The symbol DIN has been registered in the name of the German body and its prestige is constantly growing.

[4] A few revisions have been made since the original system was adopted in 1920, but these have not changed its essential character.

facturer to select the sub-system that is most appropriate for his particular needs.[5]

As to the ratio between the applications of the two sub-systems by German industry as a whole, one gage manufacturer stated to the writer that 80 per cent of orders for gages is for those to be used for fits in the basic-hole system, and 20 per cent for gages for basic-shaft fits. Consequently, this manufacturer keeps the former gages in stock, but not the latter. The fact that 20 per cent of the gages

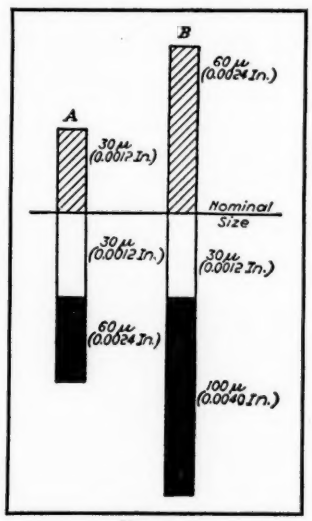

FIG. 1
Two German Standard Fits of the Same Class (Running Fit) but of Different Grade (Fine and Medium)

are used for fits in the basic-shaft system confirms the correctness of the viewpoint taken by the German committee, that the requirements of those needing a basic-shaft system should not be neglected in establishing a national standard system of fits.

In addition to the concept "class of fit"—the class of a fit depends on its allowance[6]—the Germans adopted formally "grades of fit." The grade of a fit depends on the relative magnitude of the tolerance on the parts. That is, if two loose fits A and B, for example, have the same permissible minimum clearance (see Fig. 1), while the tolerances on parts A are smaller than those on parts B, fit A is of a higher grade than fit B. Evidently, the possibility of variation in actual clearance is smaller in case A than in case B.

The Germans established four grades of fits, each grade comprising a series of fits of different class. The DIN system gives altogether 22 completely specified fits in each of the two sub-systems. In addition to these, other combinations between standard holes and shafts may be made, if necessary.

It should be emphasized that the relatively large number of completely specified fits has been adopted only with a view to answering the widely varying requirements of national industry as a whole. Each branch of industry will pick, from the 22 standard fits, those which suit its purpose best. In other words, it is a rare exception—occurring only in very large concerns manufacturing products of a widely different nature—that a single firm has use for all of the German standard fits. For the same reason, it need not be feared that the co-existence of the basic-hole and the basic-shaft systems will cause confusion.

The means of controlling and maintaining the standard fits were also standardized in the German system by laying down, in the standard, the manufacturing tolerances and the permissible wear for different kinds of gages—working, inspection, acceptance, and reference gages. Consequently, it became possible for German gage manufacturers to keep standard gages in stock. By simply ordering a working plug gage, 15 B DIN 306, the user will receive a gage for a hole with a nominal diameter of 15 mm; manufacturing limits of the hole, 15.000 and 15.018 mm; manufacturing limits of the gage, 15.000 and 15.0045 mm for the "go" side, and 15.0203 and 15.0157 mm for the "not go" side. Also, this gage will have a color mark in bright blue, indicating that it serves for checking a fine-grade fit.[7]

The fact that standard gages are kept in stock by gage manufacturers greatly promotes the use of the standard fits. If a firm which so far never has applied limit gaging wishes to make a start in this field, it will find that standard gages are most easy to obtain and at the lowest cost. Under such conditions, there is no reason why such firm should look for anything else than the national system of fits.

Introduction of the DIN Fits into Practice

German industry has adjusted itself in a remarkably short period of time to the German national standard. This was due, in a large measure, to the close cooperation between manufacturers and users of limit gages.

Progress of the standard was so rapid that

[5] The present American standard gives the basic-hole system exclusively. However, the need for standard fits given in a basic-shaft system has occasionally been brought to the attention of the ASA.

[6] The "allowance" is the minimum permissible clearance or the maximum permissible interference between the mating parts, according to the definition in the American standard.

[7] The symbol DIN 306 refers to the standard sheet on which the gage in question is specified, the symbol B to the grade of fit.

an inquiry held as far back as 1925 showed that at that time 95 per cent of the gages ordered in Germany were specified to comply with the DIN system. During a visit paid by the writer this summer to several important German organizations, it appeared that orders

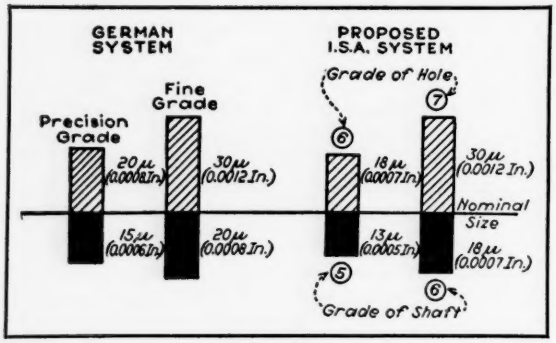

FIG. 2
Precision- and Fine-Grade Basic Holes and Shafts in German and in Proposed ISA Systems
(Range of diameters, 50 to 80 mm, inclusive)

for gages that are not in accordance with the German standard are negligible nowadays. The statement was made that the percentage of orders on DIN gages is now well over 99 per cent.

The DIN fits have been adopted by more than 1000 German organizations, this number comprising most important industrial concerns. About two years ago, a canvass was held by the German body in order to find out in how far the DIN system had given satisfactory results in practice. The outcome of that canvass was very gratifying to the originators of the system. A number of firms, active in different branches of the mechanical and electrical industry, declared that the DIN system had been successfully used in their plants, in some cases since its formal approval by the national standardizing body in 1920.

Foreign Standards Based on German System

Much attention was given to the German system by the national bodies of other countries. In fact, the DIN system was taken over, either in its entirety or with a few minor changes (as in Norway, where certain fits were left out as being superfluous for industry in that country) by the national standardizing bodies of Austria, Belgium, Holland (the DIN system supplanted here a national standard previously adopted), Italy, and Norway.

However, the real test of foreign appreciation of the German system came when the establishment of a draft for an ISA system was discussed by the sub-committee already mentioned. In that committee, Germany is the only country that has adopted the DIN system. France has no national standard as yet. The Czechoslovakian member, Professor Sawin, criticized certain features of the DIN system a few years ago. Sweden and Switzerland have adopted national systems that are different from the German.

Therefore, the fact that the other four countries agreed to a draft for an ISA proposal, based essentially on features of the DIN system, seems to prove that the latter was considered to have worked out well in actual practice. On the other hand, the German experts agree that the changes made by the international sub-committee in that part of the DIN system that has now served as the basis for the present ISA proposal are decidedly improvements, and that these improvements might not have been made for several years to come if the matter had not been taken up internationally. It is, therefore, interesting to note that in this case international cooperation has led not only to the first step required for straightening out discrepancies between existing national standards, but also to further improvements in a standard which evidently had reached a high degree of perfection. The proposed changes in the DIN system have been given full approval by German industry in a general conference recently called by the German national body.

Main Features of Present ISA Proposal—Grades and Classes of Fits

The proposal now to be laid before the member bodies of the ISA refers to two series of fits meant to cover the same ground as the

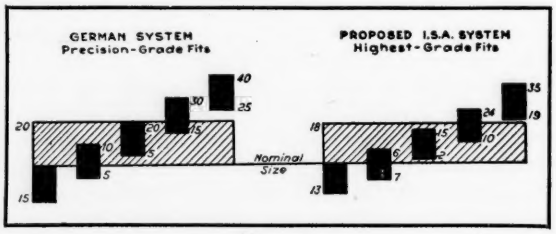

FIG. 3
Tolerances and Allowances of Highest-Grade Fits (Basic-Hole System) in German and Proposed ISA System
(Range of diameters, 50 to 80 mm, inclusive. Values in microns: 1 micron = 0.001 mm = 0.00004 in.)

precision-grade and fine-grade fits of the DIN system. The program comprises three more series of fits, two of which are meant to serve

in lieu of the DIN medium-grade and coarse-grade fits, respectively, while the third is a new grade lying between the DIN fine-grade and medium-grade fits.[8] Possibly, a further additional grade of fits will be inserted between the medium-grade and coarse-grade fits.

For easy comparison, the tolerances on basic holes and shafts, both of the precision grade and the fine grade, are shown in Fig. 2 for the

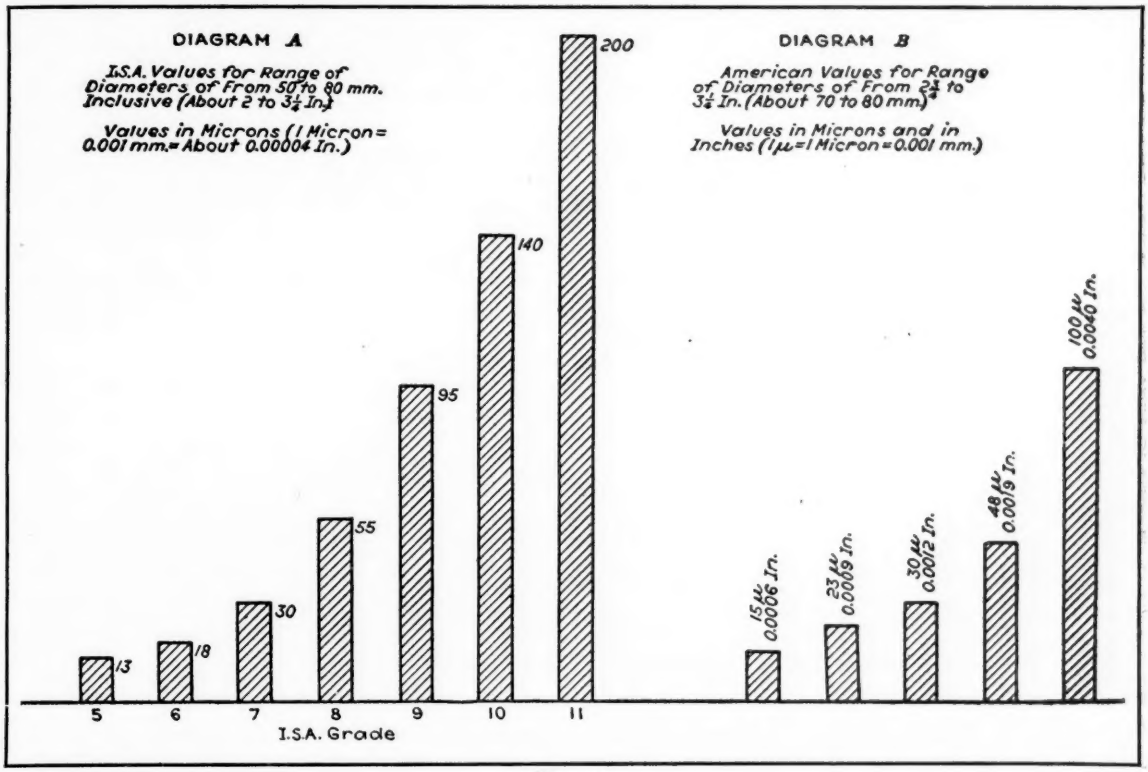

FIG. 4
Grades of Basic Holes and Shafts in Proposed ISA and in American System

DIN system and for the proposed ISA system. The tolerances are expressed in microns[9] and apply to parts with a nominal diameter between 50 mm and 80 mm, inclusive

The fine-grade hole has been taken over from the DIN system without change, whereas the tolerance on the fine-grade shaft has been slightly reduced—from 20 to 18 microns in the range of sizes under consideration.

The precision-grade hole and shaft have both been refined by a reduction of their tolerances.

The positions of the tolerances with regard to the reference line (nominal size) are also important, as they determine the allowances of the fits.[10] For the fine-grade fits, these positions have essentially remained the same in the proposed ISA system as they are in the DIN system. For the precision-grade fits, however, the ISA tolerances lie somewhat more closely to the reference line than the DIN tolerances (see Fig. 3). In other words, whereas the fine-grade DIN fits have undergone a refinement consisting almost exclusively in the reduction of the tolerances on hole and shaft, the precision-grade DIN fits have been refined both by the reduction of hole and shaft tolerances, and by a shift of these tolerances in the direction of the reference line.

While, for the sake of facility in building up a system of fits, the concept "grade of fit" has still been used in elaborating the ISA proposal, it is the definite understanding of the subcommittee that the formal sub-division of the fits on the basis of their grade, and even the explicit specification of classes of fit, should be abandoned. That is, the proposed ISA system will be based on the principle of letting the user of fits select for himself the combination

[8] This new grade of fits is meant to eliminate such objections against the DIN system as were raised a few years ago by Professor Sawin.

[9] The micron is usually indicated by the Greek letter μ (mu). One micron equals 0.001 mm or about 0.00004 in.

[10] For definition of "allowance," see Footnote 6.

of a standard hole and shaft suitable for his purpose.[11]

The concept "grade" will be conserved with regard to a hole or shaft. According to the ISA proposal, the requirements of all fits—that is, of the two grades of fits now worked out, and of the three further grades still to be elaborated—will be covered by seven grades of holes and shafts. These are represented in Diagram A of Fig. 4 showing the numerical values of the tolerances on parts—holes or shafts, as the case may be—with a nominal size between 50 and 80 mm, inclusive. Diagram B, Fig. 4, shows the five grades of holes and shafts on which the American standard system of fits is based, for parts with a nominal size of from $2^3/_4$ to $3^1/_4$ in., inclusive.

The proposed ISA grades of holes and shafts have been numbered 5 to 11, inclusive. The reason the grade with the closest tolerances has not been numbered 1, but 5, is that still closer tolerances are to be used for different kinds of gages. Thus, plug and snap gages for inspecting product of the precision grade, that is, product with grade-6 holes and grade-5 shafts (see Diagram A, Fig. 4) are to be manufactured with tolerances according to grade 2. Again, the reference gages used for checking these inspection gages must be delivered within tolerances corresponding to grade-1.

[11] In the German and also in the American and other national standard systems of fits, combinations of holes and shafts other than those explicitly specified in the standard are permitted. However, there is a certain natural emphasis on fits that are completely given in these standards and this emphasis will be absent in the ISA system. In this respect, the latter will be similar to the British national standard system.

Tolerances on Gages and Their Permissible Wear

Having thus arrived at the question of the gages, we find that in this respect the ISA proposal is a remarkable example of reaching compromise between two opposite points of view.

In the international sub-committee, the French held the viewpoint, also taken in the American standard, that no variation in the sizes of the gages should be permitted which would lead to the possible acceptance of product exceeding its own manufacturing limits. This principle concerns both the manufacturing limits of the gages themselves and the extent to which they are permitted to wear off in use. According to the French standpoint, the tolerances on the gages and their permissible wear should therefore be specified in the manner shown in Diagram A, Fig. 5.

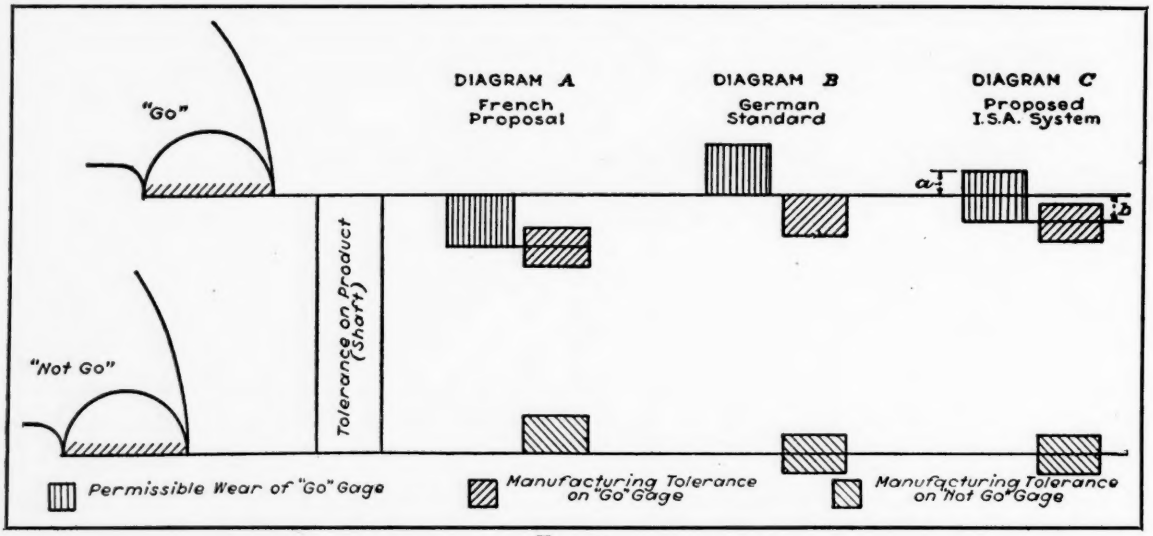

FIG. 5
Manufacturing Tolerances on Gages and Their Permissible Wear

The German standard, although keeping the manufacturing tolerance on a "go" gage within the tolerance on the product (see Diagram B, Fig. 5), permits the "go" gage to wear a certain amount past the limit of the product which the gage must control. The "not go" gage is given a bilateral tolerance. In the German system, it is therefore theoretically possible for the product to get slightly outside its limits, both on the "go" and the "not go" side. It is claimed that in practice this possibility does not lead to any difficulty whatsoever.

In the ISA proposal, a compromise between these two opposite attitudes has been reached by placing the permissible wear astride on the "go" limit of the product (see Diagram C, Fig. 5), and by giving the "go" gage a bilateral tolerance with regard to the dimension at which wear is supposed to begin. The bilateral tolerance on the "not go" gage was taken over in the ISA proposal from the DIN system on the ground that gages are generally delivered by the manufacturer with a size lying very closely to the average between their two extreme limits.

The tendency to leave to each country as much freedom as possible to work out its own solution of the problem, instead of setting up a rigid standard supposed to be adhered to by all parties concerned,[12] is shown by the fact that the dimensions *a* and *b* in Diagram C, Fig. 5, are specified in the ISA proposal as limiting values. That is, each country may specify, in its national standard, a smaller value for *a* and *b*, if it so desires. In the American standard, the value of *a* is zero.

In general, it may be said that the importance of the difference in attitude with regard to the above matter will diminish the more the tolerances on gages are reduced through constant improvement in their manufacture, and the more their wear is slowed down through increased hardness of their surfaces, for example, through the use of chromium plating or tungsten-carbide alloys. The latter are said to guarantee the gage a life that is forty times longer than that of a steel gage.

The ISA Proposal Seen from the American Standpoint

With regard to the question whether the American groups are likely to be interested in the ISA work on fits, the following can be said:

Participation in the work so far performed under ISA auspices, in general, not merely on fits, has been restricted to the European countries and Japan. This is due to the fact that the American Standards Association, representing the only "inch" country among the member-bodies of the ISA, joined the ISA as recently as the fall of 1929 and has not formally appointed any delegates on ISA technical committees as yet.[13] However, informal cooperation between some of the ISA technical committees and American groups has been going on in the form of exchange of information through the channels of the ASA.

In so far as the ISA work on fits is concerned, the above conditions have led to the situation that only metric countries happen to have participated in working out the present draft of an ISA system. At first sight it might appear that agreement between inch and metric countries on standard fits is out of the question in principle, for the simple reason that there is a difference in their most commonly used nominal diameters. In practical language, the question is likely to be raised, in some quarters: "Why try to agree on allowances and tolerances for fits—measured in thousandths or even ten-thousandths of an inch—when the nominal size of a 1-inch hole or shaft differs from the nearest round millimeter size (25 mm) by as much as about $^1/_{64}$ in., that is, by an amount of a different order of magnitude than the usual allowances and tolerances?"

In this respect it should be kept in mind that there are numerous cases where it has been proved to be worth while—for the sake of international interchangeability of parts—to agree on an odd nominal size, be it in inches or in millimeters. One case in point is that of ball bearings whose main dimensions—bore, outside diameter, and width—have been laid down in a truly international standard in round millimeter sizes and their equivalent odd-inch sizes. Another case is that of Morse tapers whose original inch dimensions have been taken over and converted into odd-millimeter sizes by several metric countries as a national standard. It seems quite plausible to assume that the number of cases of this kind will increase considerably in the next ten years.

Whenever international agreement on uniform nominal dimensions is reached, it is obviously essential that the fits between the parts in question should also be unified in the several countries. This condition has already been reached with regard to the tolerances on the most current types of ball bearings. It is important to note, in this respect, that such agreement can be reached without either of the parties giving up its preferred practice of working to the inch or the metric system.

Subdivision of Range of Nominal Diameters

The proposed ISA fits so far worked out apply to nominal diameters of from 3 to 180 mm, inclusive. Work on fits for larger diameters will be started later. The subdivision of the range 3 to 180 mm into subranges for each of which the allowance and the tolerances on the mating parts remain constant, is as follows:

From	3	to	6 mm, inclusive
Above	6	to	10 mm, inclusive
Above	10	to	18 mm, inclusive
Above	18	to	30 mm, inclusive

[12] This is not the purpose of ISA activities, as is explained in more detail later.

[13] The other "inch" countries having a national standardizing body, Great Britain, Canada, and Australia, have not yet joined the ISA.

Above 30 to 50 mm, inclusive
Above 50 to 80 mm, inclusive
Above 80 to 120 mm, inclusive
Above 120 to 180 mm, inclusive

These subranges would be approximated in the inch system, closely enough for practical purposes, by the following:

From $1/8$ to $1/4$ in., inclusive
Above $1/4$ to $13/32$ in., inclusive
Above $13/32$ to $23/32$ in., inclusive
Above $23/32$ to $1\,3/16$ in., inclusive
Above $1\,3/16$ to 2 in., inclusive
Above 2 to $3\,1/8$ in., inclusive
Above $3\,1/8$ to $4\,3/4$ in., inclusive
Above $4\,3/4$ to $7\,1/8$ in., inclusive

There would still remain a very slight difference between the separating values in the inch and in the metric series of subranges. For example, $1\,3/16$ in. converted into millimeters gives 30.16 mm, instead of 30 mm. However, a check on the nominal diameters most commonly used in both systems will prove that all of these fall in corresponding subranges. This is more important than having round numbers for the separating values. Even though a value like $4\,3/4$ in. may seem somewhat artificial as a separating figure—5 in. would seem more natural, in the inch system—it will not cause any difficulty, as everybody will know at once whether a particular diameter in which he is interested is smaller or larger than this value.

The above equivalent-inch series of subranges is mentioned here simply as a possible solution, but not necessarily as the best one, from the American standpoint. It may very well be that upon closer consideration we might prefer a somewhat different subdivision of the total range of nominal diameters. Such points might be discussed with the delegates of the other countries. The only thing we have tried to prove here is the fact that, in principle, agreement on the subdivision of the range of diameters does not seem to present special difficulties.

Numerical Values of Allowances and Tolerances

The extensive comparative study of the different national systems, made by the German national body in its capacity of secretariat of the ISA work on fits, has shown that fits of a similar character have been standardized in the several countries with allowances and tolerances whose numerical values very often lie very close together and sometimes even are perfectly identical.

This is not surprising. Modern methods of machining parts are becoming more and more universal and manufacturing practice in all industrial countries must necessarily present the same problems to be solved in a similar manner. There are, of course, such variations as are due, for example, to difference in volume of production per unit of time, but, as a whole, the requirements of establishing a fit between parts expected to behave, when assembled, in a certain manner, under identical conditions, may be said in principle to be "cosmopolitan."

It seems, therefore, that international agreement, even on those details of a system of fits that concern directly the workshop, must not be so very difficult to reach. Again, the variety of fits provided by the proposed system will guarantee sufficient freedom of choice to all users of fits, while, on the other hand, the fact that cooperation has been effected will prevent unessential variations in practice from excluding interchangeability where it might be had. For example, in a specific case, a tolerance on a part of 0.005 in. may be just as good as one of 0.006 in. However, so long as no definite agreement on the exclusive use of either figure has been reached, mutual acceptance of parts will be impossible and needless diversity in practice will continue to exist.

Tolerances on Gages and Their Permissible Wear

Referring to what has been said about tolerances on gages and their permissible wear, it seems that the only point that might call for further discussion, on the American side, is the bilateral tolerance on the "not go" gage.

Conclusion

Taking all of the above considerations together, the writer suggests the following:

1

The work performed under the auspices of the International Standards Association on the subject of fits between cylindrical parts should be recommended to the attention of the American groups interested in this matter.

2

It would be desirable for the American groups to participate in this ISA work in some manner, especially as the American Standards Association, which has approved a Tentative American Standard on" Tolerances, Allowances, and Gages for Metal Fits," is a member-body of the ISA.

3

Consideration and study of the ISA proposal might advantageously be combined with a review of the above-mentioned Tentative American Standard for the purpose of ascertain-

ing whether this standard, approved in 1925, requires any revision. Evidently, any revision of the national standard desired by American industry should preferably be dealt with at the same time as the question if, and if so to what extent, American industry should participate in developing a standard which is internationally acceptable.

It cannot be strongly enough emphasized that American participation in this or any other ISA project does not commit the American groups concerned to the formal adoption of the system ultimately elaborated. It has been definitely understood, since the inception of the ISA, that this body would not set up international standards. This would not be in accordance with the basic principle adopted by the majority of national standardizing bodies, according to which industrial standardization must be carried out by national industry itself and its results adopted voluntarily by the latter, but not enforced by any agency. If this principle of voluntary adoption holds true nationally, it must, of course, also apply internationally.

However, without a body like the ISA, whose task it is to bring those interested around the table to discuss their common problems, international agreement on standards would have remained latent—for sheer lack of opportunity to discuss matters—for a long time, even in cases where it now already has been reached or is well on its way toward accomplishment.

British Advertisers Urge Standardization of Page Sizes

The Incorporated Society of British Advertisers is urging the technical and trade press to adopt standard page sizes for their journals, according to the *British Trade Review* of London for June, 1930. The proportion suggested for all sizes is 7 in. x 10 in. This would permit advertisers to have all art work prepared in this proportion for the three proposed standard sizes—$8^1/_2$ in. x 11 in., 7 in. x 10 in., and $6^1/_4$ in. x 9 in. The *British Trade Review* points out that this would necessitate the making of only three original plates for advertisements, no matter how many publications they are to be used in, electrotypes being made when they are to appear in more than three publications.

The *Review* points out the desirability of the application of this principle to engineering trade catalogues. The standardization of such literature in style, lay-out, and terms used would facilitate the preparation of standard translations of commercial and technical terminology in other languages. The *Review* considers the international standardization of the terms used in catalogues a matter of greatest importance:

> "Anyone who has handled British editions of foreign prepared catalogues knows how numerous can be the slips in all good faith on the part of the would-be polyglot compiler on the staff of the manufacturer, or retained by him at some publishing house. The recipient here of this sort of pidgin-English should imagine the feelings of the Spaniard in South America who gets a similar sort of descriptive list, or worse still technical information in amateur terminology. The result cannot but be misleading and disappointing to both parties."

Canadian Organizations Work Out Cooperative Program

A program of cooperation is being developed between the Canadian Engineering Standards Association and the Canadian National Committee of the International Electrotechnical Commission, according to the following quotations from the June, 1930, issue of the C.E.S.A. *Bulletin:*

> "Negotiations have been going on for some time between the C.E.S.A. Executive Committee and the Canadian National Committee of the International Electrotechnical Commission, with the object of establishing closer relations. The C.E.S.A. Secretary was appointed Secretary of the National Committee some time ago and the suggestion has been made that the Canadian National Committee of the the I.E.C. be constituted the I.E.C. Committee of the Canadian Engineering Standards Association so that it will now come under the sponsorship of the C.E.S.A. Sectional Committee on Electrical Work. Previously the Canadian National Committee has been one of the Committees of the Engineering Institute of Canada but the Council of the I.E.C. has expressed its willingness to relinquish this sponsorship in favor of the C.E.S.A. It is hoped shortly to have this arrangement confirmed by the C.E.S.A. Main Committee and also by the International Electrotechnical Commission. This should prevent much overlapping in the work of electrical standardization. This is interesting in the light of the suggestion recently made by the American Institute of Electrical Engineers which was reported in the C.E.S.A. *Bulletin* for March 31, 1930."

British Chemical Interests Plan Standardization Program

A program for the development of standardization, safety regulations, and the statistical analysis of British chemical production, is going forward under the direction of the Association of British Chemical Manufacturers and the British Engineering Standards Association, according to an article in the July 25, 1930, issue of the *Chemical Trade Journal and Chemical Engineer*. A proposal for the organization of a British chemical standardization body was enthusiastically supported at a recent conference of representatives of all chemical interests, and a special committee has been formed to explore the possibilities of chemical standardization in cooperation with the British Engineering Standards Association.

The Association of British Chemical Manufacturers has, for convenience in promotion and research, grouped its industries in the following order:

1. Acids (including Acetic and Oxalic); Carbonic Acid; Hydrogen; Oxygen and Gases; Alum; Chrome; Zinc, Copper, and Iron Compounds; Fertilizers (including Super-Phosphates).
2. Alkalies; Cyanides; Chlorine and Compounds; Silicates; Chlorates; Borax; Hydrogen Peroxide; Magnesia Compounds (not Medicinal).
3. Fats; Greases; Waxes; Resins; Glycerine; Soap.
4. Gelatine; Sizes; Glue; Varnishes; Paints; Polishes, Tanning.
5. Coal Tar Primary Products (excluding Ammonia and Ammonia Products).
6. Fine Chemicals—Analytical, Pharmaceutical, Photographic; Rare Earth; Synthetic Essences and Perfumes; Alcohol Derivatives; Ethers.
7. Phosphorus; Manganese; Potassium, Sodium, Barium, Calcium, Cadmium, etc.; Lead; Arsenic; Antimony; Tungsten; Molybdenum, etc.
8. Cellulose Products (including Paper); Celluloid; Rubber and Substitutes.
9. Explosives and Dyes and their Intermediates.
10. Glass; Porcelain; Pottery; Refractory Materials; Lime; Cement; Chemical Resisting Materials.
11. Allied Industries: (a) Bleachers, Dyers, and Textile Printers.
12. Distillation of Coal, Shale, Oils, and Wood; Alcohol; Acetone; Ammonia and Ammonia Products; Charcoal; Fuels.

These groups have committees of their own to do the detail work and hold meetings as often as may be necessary.

A Works Technical Committee is preparing a section of the British "Model Safety Rules." In this activity it is said that the French and German Associations corresponding to the Association of British Chemical Manufacturers have agreed to collaborate by providing all the useful information which they possess. The idea underlying this collaboration is that safety in industry should be regarded as in the same category as medical science.

The issuing of safety circulars by the Works Technical Committee has been well received and a steadily increasing demand for these circulars has been noted.

Australian Association Reduces Building Material Variety

The widespread effort to reduce building costs through standardization and simplification of building materials has resulted in a study of the matter by the Standards Association of Australia. The Association found, after conference with architects and manufacturers, that the 150 different varieties of galvanized iron ridging, guttering, and down-piping available could be reduced by 70 per cent. One hundred and twenty different sizes of plywood panels for doors were reduced by 60 per cent.

> "This course," says the *Australasian Manufacturer* of Sydney, "is undoubtedly a wise policy to adopt, for there will be a great saving in time and labour in the temporary stopping of machinery for the purposes of re-setting; and, further, this will naturally result, ultimately, in the appreciable reduction of costs of production."

Standardization in Roumania

The establishment in Roumania of a Department of Rationalization and Standardization to prepare standard specifications for the use of the Government was recently effected. According to a letter received from the national standardizing body, the new Department will work in harmony with the national standardizing body as is the case in other European countries. Specifications required for the use of the Government which have not yet been formulated under the auspices of the standardizing body will be only tentatively adopted by the Government to be replaced later by specifications approved by the standardizing body.

Canadian Standards for Structural Steel Available

A new edition of the "Standard Specifications for Steel Structures for Buildings" published by the Canadian Engineering Standards Association, has been received by the American Standards Association.

Among other changes noted in this second edition of the standard are those which increase permissible unit stresses; and particularly the permissible unit stress for axial tension, which is raised from 16,000 lb (7.14 tons) per sq in. to 18,000 lb (about 8 tons) per sq in. Other notable revisions are those in the column formula and for standard allowances for snow load and for wind load on roofs.

Copies of the standard may be purchased through the ASA Information Service at 25 cents each, or may be borrowed for review.

Canadian Association Approves New Standards

In its *Bulletin* of June 30, 1930, the Canadian Engineering Standards Association announces the following new standards:

B18-1930—Established List of Stove Bolts
G30-1930—Standard Specifications for Billet-Steel Reinforcing Bars
G31-1930—Standard Specifications for Rail-Steel Reinforcing Bars
G32-1930—Standard Specifications for Steel Wire for Concrete Reinforcement

Commenting on these standards, the C.E.S.A. *Bulletin* says:

"B18-1930—This publication constitutes the second edition of specification B18-1925 'Standard Specification for Stove Bolts.' The material has been rearranged to correspond to the established list of machine screws but otherwise no revision has been made. This publication has been issued in pamphlet form for insertion in the binder under the general title of 'Established Lists of Dimensional Standards.'

"G30-1930; G31-1930; G32-1930—These three publications constitute a revision to specification A9-1923 'Standard Specification for Reinforcing Materials for Concrete' and it has been thought advisable to reclassify these specifications under Ferrous Metals, rather than under Civil Engineering and Construction.

"....Upper limit in tensile strength for intermediate grade steel has been raised from 85,000 to 90,000 lb per sq in., and the minimum elongation of 8 in. for tensile strength bars has been fixed at 16 per cent for plain bars and 14 per cent for deformed bars. In the specification covering rail-steel reinforcing bars the only revision consists in more closely defining the source of material used in the manufacturing of these bars. A feature of these specifications is the inclusion of a supplement covering an established list of sizes for round and square reinforcing bars, and the use of this list is strongly recommended to designing engineers, architects, and purchasing agents. The specification covering steel wire for concrete reinforcement has been revised to allow maximum diameter of wire to 0.625 in. and equivalent diameter of gauge numbers are now listed according to Imperial Standard gauge."

British Tar Standard Published

A British standard covering the methods of testing tar and its products has recently been received at the ASA office. The standard contains complete and precise instructions for testing tar and will be of value to chemists, and others interested in road materials.

The standard gives definitions and the recommended methods of sampling, together with details covering standard procedure for the determination of specific gravity and the method of distillation. Tests for tar and tar products cover: crude tar; refined tar, including road tar; lower boiling fraction; tar acids; naphthalene; tar bases; creosote oil; crude anthracene; and pitch.

Laboratory apparatus suitable for use in the testing of tar is described in a special appendix.

Copies of this 22 page standard, No. 76-1930, may be borrowed, or purchased from the ASA Information Service for 60 cents each.

The Maintenance of Marble

An excellent booklet, "Maintenance of Interior Marble," has been published by the National Association of Marble Dealers, a significant type of trade association activity closely akin to standardization. The booklet was prepared by D. W. Kessler, Research Associate, of the Bureau of Standards. It contains sections on cleaning treatment for various types of stains, and special treatments such as those for the prevention of stains and for waterproofing.

Copies of the booklet may be obtained through the ASA Information Service.

Lack of Generally Recognized Standards Lowers Consumption of Commodities

A Discussion of the Need for Standards in Two Widely Separated Industries—Meats and Paints

The effects of generally recognized standards in opposing a decline in the consumption of a commodity are ably discussed by Mr. C. E. Gibbons, Senior Marketing Specialist, Department of Agriculture, in a publication of the Department, "Advantages of Standards for Livestock and Meats." Although the publication deals entirely with the meat industry, Mr. Gibbons' statements apply with equal force to many other industries. The following quotations are taken from the publication:

> "As the route (referring to the elaborate chain of operations and transactions which takes place in the marketing of dressed meat) is usually long and winding and the machinery is sometimes complicated, it is highly desirable to reduce to a minimum the time and effort involved. Probably nothing will contribute more to such reduction than a set of generally understood and accepted official standards.
>
> "Standardization involves developing a system of labeling in which commodities and trade units of commodities are designated by well-established and understood titles or names. Under such a system a single label may so define and identify as to eliminate the need for elaborate description or personal inspection. Under such circumstances 'prime,' 'choice,' 'good,' 'medium,' stand for certain well-defined, carefully limited things; and the mere mention of these names, with proper context, brings to the mind of one familiar with their significance definite pictures of animals, carcasses, or cuts. Choice grade is then 'choice' grade for buyer and seller alike, regardless of supplies, demand, season, geographic location or other considerations....
>
> "After the sale is consummated it usually is a comparatively easy matter to learn what price a certain load of steers brought, but it is a different matter to tell the stockman in the country or a packer in a distant city just what kind of steers brought the price. It is here that universal standards and standardized grade names will assist the market and all market agencies."

The following is particularly in point and there seems no reason to suppose that it does not apply with equal force to all products and commodities sold upon a basis which involves the buyer and seller making judgments of quality:

> "Standards will not, of course, determine the market price of a commodity; nor can they determine what a packer should pay for a 'choice' grade steer at a given market on a given day; nor what a producer should ask or receive for such a steer, for the market price of any commodity depends upon many things besides grade. Such standards will, however, make it possible quickly and definitely to ascertain the grade of the commodity and will provide a definite basis for quoting prices....
>
> "The experiences of the consumer and his reaction thereto have a vital bearing on the welfare of the whole livestock and meat industry. Unless he can obtain meat which, in all essential respects, comes up to his requirements and expectations, the consumer is likely to use less and less of that commodity and may eventually turn largely to other food products. From observation it seems likely that in every section of the country meat consumption is falling considerably short of its maximum possibilities largely because consumers so often find their meat purchases disappointing in that they fail to give a degree of satisfaction commensurate with their cost....
>
> "With such standards in effect," says Mr. Gibbons, "the problem of the housewife and consumer will be reduced to one of deciding which grade is preferred under existing circumstances. With that decided, an order can be placed by telephone, and the consumer can feel sure that it will be properly filled."

In commenting upon Mr. Gibbons' statement, *Food Industries* for July, 1929, pointed out the importance of the trade association

in establishing standards which will lead to increased consumption:

> "A decline in meat consumption in the United States is blamed by a marketing specialist of the government upon inadequate standards for meat. Without undertaking to say whether Dr. C. E. Gibbons, of the Bureau of Agricultural Economics, who is responsible for this conclusion, can unquestionably substantiate his thesis, we do believe that his statement refers to a fundamentally sound principle of food production and one that is all too often ignored.
>
> "Dissatisfaction with a can of peas results not alone in criticism of the particular brand involved. It results also in a tendency on the part of the housewife to buy something other than peas next time she wishes a vegetable. In a word, inferior quality of food product hurts not only the producer responsible; it hurts all of the industry from which this product comes.
>
> "The food industries of the United States are only now beginning to be so organized that they can work as complete industrial units in matters of national importance. The formation of effective trade associations has for the first time given a real tool by which to hew out a constructive and effective policy for all producers and merchandising elements of any particular commodity group.
>
> "Some of these trade organizations have already recognized their opportunity for serving their industries, as well as for public service, through establishment of quality standards. More groups must recognize this opportunity and this duty. Through the voluntary adoption of standards, and voluntary compliance therewith, public good will can be fostered and a basis laid for permanent profits. We commend for the study of all food groups the conclusion of Mr. Gibbons which is referred to."

Situations similar to that described by Mr. Gibbons have been noted not infrequently in the case of other commodities, and much of the work of the Federal Trade Commission in the field of trade practice conferences would appear to be related to efforts on the part of industry to correct unsatisfactory distribution conditions arising from lack of standards, both for goods and for trading methods. To instance another field where the existence of this problem is recognized, there are many in the paint trade, for example, who feel that the gradual degradation of quality which has been taking place in this industry through the pressure of competition has had a bad effect upon the whole paint market in that a portion of the public has come to doubt the claims of quality and durability made for paint without in most cases, perhaps, being aware of the exact nature of the change which has taken place in the product. As is well known, only the federal government and unusually large industrial users of paint are buying in great quantity paints, varnishes, and enamels which are at the same time reasonably priced and free from adulterants, filters, and extenders. These have been increasingly used to replace the more costly compounds of lead and zinc, as pigments, and pure linseed oil and turpentine as vehicles.

Experts believe that better knowledge of paint ingredients and their proper use would increase paint consumption one or two hundred per cent.

American Home Economics Association Seeks Labels for Consumer Goods

The following resolution of the American Home Economics Association has been formally transmitted to the American Standards Association by Miss Alice L. Edwards, Executive Secretary of the American Home Economics Association:

> "Resolved that the members of the American Home Economics Association cooperate with the United States Bureaus of Home Economics and of Standards and with the American Standards Association in an attempt to secure more labels for consumer's goods which will give accurate information to the over-the-counter buyer. The members of the Association have many inquiries from housewives who feel themselves handicapped in purchasing because of the lack of such labels. The very great development during the last twenty-five years of new kinds of household goods has resulted in confusion in the minds of ultimate consumers, and there is a demand for the development of scientific purchasing information.
>
> "Be it further resolved, that the American Home Economics Association request the American Standards Association to initiate an investigation of methods of safeguarding the interests of the ultimate consumer, when labels in terms of specifications are used. At the present time, the American Home Economics Association does not have the funds for systematic work of this sort. Neither the American Standards Association, the Bureau of Home Economics, nor

the Bureau of Standards has the facilities for doing such policing, but it is very important that machinery be set up for preventing the misuse of labels misleading to the purchaser."

In transmitting the resolution, Miss Edwards also states:

"Very great interest was shown by the members of the Association in the problems having to do with the standardization of consumer's goods. Labeling is recognized to be one very definite feature of the program. It was further recommended that: 'Insofar as they are able, members of the American Home Economics Association test the accuracy of labels and of advertising in terms of specifications, and report the results of their work to the Committee on Commercial Standardization and Simplification.' "

NEMA Announces New Standards

The National Electrical Manufacturers Association announces that at the meeting of its standards committee held on August 5th, the following new Association standards and revisions of existing standards were approved:

Engine-Driven Alternators. New standard ratings of voltage, kilowatts, and speed for 25, 50, and 60 cycle alternators, 80 per cent power factor, from 1 to 8000 kw and from 4 to 90 poles. New rules on a standard performance specification blank, on overspeed limitations and on position of terminals. A new table on temperature rise of 40 C, 80 per cent power factor engine-driven alternators.

Planer Type Motors. Standard speeds and speed ratios for planer type motors having 4 to 1 and 6 to 1 speed ratios.

Elevator Motors and Motor Generators. Standard on basis of rating of motor-generator sets for operating elevators using generator field control. Standard on basis of rating of d-c, gearless traction elevator motors, class DL.

Drip-Proof Fully Protected Motors. Standard definition and temperature rise of drip-proof fully protected motors.

Crane Motors. Standard horsepower and speed ratings of open-type intermittent-rated slip-ring a-c crane motors, from 2 to 300 hp, 60 and 25 cycles.

Oil Circuit Breakers. Standard on application of oil circuit breakers to single-phase systems below 66,000 volts having one conductor grounded. Standard on application for interrupting capacity on solidly grounded-neutral systems. Standard for drain valves of oil circuit breakers.

Switching Equipment. Standards for rating and capacity of grounding switches. Standard steel specifications for outdoor stations.

Transformer Impedance. Change in the standard tolerance factor for impedance volts of distribution transformers.

Attachment Plugs. Standard terminal dimensions for small table heating appliances.

A joint committee of the NEMA with the Electrical Testing Laboratories in connection with quality improvement programs on electric ranges has been appointed, and a joint committee of the NEMA and the National Electric Light Association on high-tension porcelain standardization was authorized by the Standards Committee.

British Electrical Standardization

Electrical standardization work by the British Engineering Standards Association has been instrumental in improving quality and lowering costs, according to an article in *Electrical Industries*, London, January 8, 1930. The article says in part:

"...the increased turnover which has taken place since the war years has been chiefly due to improved methods of handling and costing, and to the extent to which electrical goods have been successfully standardized by the B.E.S.A. Certainly in most branches of manufacture, whether it be generators, motors, transformers, cables, or other accessories, research and standardization have been effectively made use of, which has resulted in improved quality but diminished cost, so that our manufacturers can now hold their own and compete successfully with American and Continental competitors."

German Boiler Specifications

The German national standardizing body has issued two books entitled, "Specifications for Materials in the Construction of Stationary Boilers" and "Specifications for Materials in the Construction of Marine Boilers." These books reproduce a number of German standard (DIN) sheets and contain information about boilers. Copies may be borrowed or purchased through the ASA Information Service.

ASA Approves Revised Safety Code for Lighting Factories

A revision of the "Code for Lighting Factories, Mills, and Other Work Places" (A11-1930), which has been developed under the sponsorship of the Illuminating Engineering Society, has been approved by the ASA Standards Council as American Standard. The scope of the code is described in the introduction as follows:

> "...a guide for factory owners and operators in their efforts to improve lighting conditions in their factories. It makes available authoritative information for legislative bodies, factory boards, industrial commissions, and others who are interested in enactments, rules, and regulations for better lighting."

The importance of the code is indicated in Part I "Advantages of Good Illumination" in which the effects of good lighting are listed as follows:

Reduction of accidents
Greater accuracy in workmanship, resulting in improved quality of goods
Increased production
Less eyestrain
Greater contentment of workers
Greater cleanliness
More order and neatness in the plant
Supervision of the employees made easier

The figures given under the heading "Reduction of Accidents" and included in the following quotation are of great interest to industry as a whole:

> "The National Safety Council in its publication 'Accident Facts—1929,' estimates the number of fatalities in the United States arising out of, or in the course of gainful employment, as 24,000 for the year 1928, and also that during the same period the lost time non-fatal accidents reached the staggering total of 3,125,000—about one accident for every four persons engaged in industry, or one for every 14 persons gainfully employed.
>
> "According to R. E. Simpson of the Travelers Insurance Company, there is warrant for assuming that defective vision and deficient or unsatisfactory lighting installations are contributing factors in 18 per cent of these accidents. Simple computation will show that from these causes industry is being deprived of the equivalent of the services of 35,000 men throughout each entire year due to the lost-time non-fatal accidents, and that the accepted actuarial methods of evaluating fatal accidents will bring the total loss to 125,000 men annually....
>
> "Compensation insurance premiums for a plant are based on the amount of the pay roll, and the rate is determined by the accident experience of a given industry, modified by the experience of the particular plant under consideration. With a rate of $1\frac{1}{2}$ per cent the annual premium in the case of 1000 employees at an average wage of $40 per week would be $31,200.
>
> "An insurance carrier might on an average pay the claims resulting from four accidents per month in this plant, and meet its own overhead costs, and still have a slight margin of profit. An experience of five accidents per month, one-fifth of them due to improper lighting (a not unlikely event), would probably leave the insurance carrier no option but to increase the rate by 25 per cent. The premium would then be $39,000—an increase of $7800. If poor lighting costs only $3 per employee or $3000 per year total, the owner's annual expense for poor illumination actually amounts to $10,800—of which $7800 is required by the insurance company to meet additional accident claims. An expenditure of $6 to $8 per year per employee for more adequate illumination might save a large portion, if not all, of the latter amount."

Savings effected in economy of production by good illumination are estimated to be a significant item to the factory owner. The estimate prepared by the committee in charge of the Code assumes that one 100-watt incandescent electric lamp will take care of one operator; that the lamp burns on the average of two hours per day, 300 days per year; that the life of the lamp is 1000 burning hours; and that the operator works eight hours per day, 300 days per year, at 45 cents per hour. The total cost of maintaining good illumination,

including the investment and the annual operating cost, is, therefore, placed at $6.00 per man per year. The cost of labor (the annual wages per man per year) are estimated at $1080. If an operator, because of good illumination, saves in production or in better quality of product the equivalent of only three minutes per day for 300 days, he will offset the annual cost of the illumination. Conversely, the operator losing, for example, 30 minutes per day through poor illumination loses $60 per year, or ten times the cost of providing proper lighting.

Part II of the Code includes sections on measurement of illumination; recommended levels of illumination, including tables for various industrial interiors; avoidance of glare; and importance of adequate electrical wiring.

A "Suggested Minimum Regulation to Be Established by State Authorities" comprises Part III of the Code.

Copies of the revised Code are available for review, or purchase at 20 cents per copy, through the ASA Information Service.

ASA Coal Committee Reports on Work

A review of the work being done by the ASA sectional committee on the classification of coal (M20) is contained in a report made by Mr. H. A. Kidder, representative of the American Electric Railway Association on the committee, to Mr. G. C. Hecker, General Secretary of the Association. In his report Mr. Kidder says:

> "During the year, the three technical committees have amassed a large amount of data on their respective subjects.
>
> "The technical committee on scientific classification through its sub-committees has been exceptionally active.
>
> "The sub-committee on methods of analyses, origin, and composition of coal has continued its experimental work on accelerated slacking test which it is hoped may furnish a quick method of evaluating the slacking properties of coal. Work is also being continued on the friability test at the Pittsburgh Station of the Bureau of Mines, by means of the ball-mill method, similar to that used by the Canadian Bureau of Mines. Acid extraction of the mineral matter of coal is being tried and an investigation of the air drying losses and moisture determination on low rank coals is being made. A further study is being made of the calculated ash correction as used in the unit coal calculation.
>
> "A review of the progress of the sub-committee on nature, location, and mode of occurrence of types of American coals, together with additional information, was presented. The committee adopted resolutions approving the tentative subdivisions of coal into groups, classes, and types. The four general groups are to be anthracite, bituminous, sub-bituminous, and lignite.
>
> "The sub-committee on present and proposed systems of coal classification reported considerable work done in plotting analyses of different coals on the graphic chart presented last year. Due to the large amount of work involved, the committee requested the employment of at least one man to devote his whole time to this work, the cost to be defrayed by funds to be raised by the sectional committee.
>
> "The technical committee on use classification is still working up data on the different grades of coal used by various industries. A questionnaire is being prepared to be sent to all users of coal for steam generation.
>
> "The technical committee on marketing practice has prepared a comprehensive report on all coals, including analyses, delivered at various market centers throughout the United States.
>
> "In order to give publicity to the work of the technical committee on scientific classification of coal, it was decided that papers should be presented at the coal classification symposium to be held by the American Institute of Mining Engineers at the February meeting. Several papers were presented by different members of the committee.
>
> "It might be well to note at this time that the Canadian Coal Classification Committee, sponsored by the National Research Council of Canada, is cooperating with the American Committee—representatives have attended all meetings. Mr. R. E. Gilmore, Superintendent, Fuel Research Laboratories, Department of Mines, Ottawa, Ontario, Canada, holds a membership at large on the American Committee.
>
> "The progress made by the committee is to be commended. Definite classification of coal should be expected during the coming year."

New Standards Available

The following American Standards are now available for purchase through the ASA Information Service:

B5e-1930—Cut and Ground Thread Taps, 50 cents.
B5c-1930—Nomenclature of Milling Cutters, 75 cents.

Report on Electrical Symbols Revised

There has been issued a revised report (17g2) on graphical symbols for electric power and wiring (Z10g2) under date of July, 1930, prepared by the Sectional Committee on Scientific and Engineering Symbols and Abbreviations.

This report is a revision of that issued in March, 1930, and the changes which have been made are a result of the large number of criticisms and suggestions which have been received from interested persons. The report differs from the one it supersedes chiefly in that the symbols for industrial power switchboard control and auxiliary devices have been omitted. The preface states that

> "this omission is due to the wide divergence of opinion and of manufacturers' practice which has been found to exist. A supplementary report covering the subject is recommended when sufficient accord can be obtained particularly among the manufacturing companies."

Copies of this report may be had free of charge from the ASA Information Service.

Standards Requested for Gas Burning Appliances

The American Gas Association has made a formal request to the ASA that it be given sole sponsorship for a project entitled "Approval and Installation Requirements for Domestic Gas Burning Appliances" (Z21) with the following scope:

> "Establishment of minimum or basic requirements for safe operation, satisfactory performance, and substantial and durable construction for domestic gas burning appliances; together with laboratory methods of test for determining compliance therewith."

This request has received the favorable consideration of a special committee which has recommended that the A.G.A. be granted a sole sponsorship for the project with the scope as given above. Final action will be taken at the meeting of the Standards Council to be held on September 11th, as well as upon the personnel of the proposed sectional committee.

For a number of years the American Gas Association has tested domestic gas burning appliances in its laboratories and they have permitted those manufacturers whose devices have satisfactorily met the requirements of the Association to attach the seal of approval of the Association. It is now proposed that the requirements of the A.G.A. be submitted to a sectional committee broadly representative of all having a major interest in domestic gas burning devices in order that the requirements may be accorded the status of American Standard, thus enabling purchasers of gas burning devices to know in advance what they may expect from a device bearing the seal of the A.G.A.

Face to Face Dimensions of Ferrous Flanged Valves

In January, 1927, the American Society of Mechanical Engineers (A.S.M.E.) asked the American Standards Association (ASA) to have the standardization of "face to face dimensions of flanged valves" taken up under its procedure. The ASA referred this request to a special committee of six members as follows:

W. C. Cushing, American Railway Association (A.R.A.), Chairman.
H. B. Gombers, Heating & Piping Contractors National Association (H.P.C.N.A.).
A. M. Houser, American Society of Mechanical Engineers (A.S.M.E.).
A. J. Jupp, Manufacturers Standardization Society of the Valve and Fittings Industry (M.S.S.).
I. E. Moultrop, National Electric Light Association (N.E.L.A.).
W. J. Serrill, American Gas Association (A.G.A.).

In its report to the Standards Council, dated October 3, 1927, this special committee unanimously recommended that the project should go forward under the auspices of the ASA

> "for the reason that a number of user organizations have already expressed a desire to have the center to face dimensions of ferrous flange end valves standardized, and for the further reason that the Manufacturers Standardization Society of the Valve and Fittings Industry has expressed a desire to have the subject formally considered."

It was further recommended that "the types which should be included are ferrous gate, globe, angle and check valves having flange connecting ends and W.S.P. ratings of both 125 and 250 lb per sq. in."

Finally it was recommended that the work on this subject be assigned to the existing sectional committee on "Pipe Flanges and Fittings," the latter project being closely related to the new subject. This sectional

committee is sponsored by the American Society of Mechanical Engineers, the Manufacturers Standardization Society of the Valve and Fittings Industry, and the Heating and Piping Contractors National Association.

The above recommendations of the special committee were unanimously approved by the American Standards Association, October 30, 1927. A sub-committee (No. 5) of the sectional committee to deal with the subject was appointed.

One of the items so far considered by the subcommittee is "Center to Face Dimensions of Check Valves in Iron and/or Steel for Pressures Less Than 400 lb Steam." The Manufacturers Standardization Society of the Valve and Fittings Industry has now declared itself to be opposed to having this subject dealt with in a letter dated July 14, 1930, to the chairman of the sectional committee, Professor Collins P. Bliss. The letter states that the attitude of the Manufacturers Standardization Society of the Valve and Fittings Industry is

> "predicated upon the belief that in view of the many varieties of designs and the relatively limited demand individually therefor, such standardization would be an uneconomical project."

Another subject on which work has been done by the new sub-committee is "Center to Face Dimensions of 150 lb Steel Flanged Globe and Angle Valves." The Manufacturers Standardization Society of the Valve and Fittings Industry has declared itself not to be in favor of work on this subject going forward, either. The letter in question says that its decision is

> "predicated upon a very thorough study of the situation and the feeling is expressed that the industry, through the Manufacturers Standardization Society of the Valve and Fittings Industry, is amply justified in refusing to indulge in the expense of developing a standard for any commodity for which there is not yet a visible demand of sufficient scope to warrant such development expense."

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Standardization of Leather Belting Recommended

The special conference committee, organized at the February 6th conference on the standardization of leather belting, and which is under the chairmanship of J. C. Mattern, Singer Manufacturing Company, Elizabethport, New Jersey, has recommended that the American Standards Association undertake the standardization of vegetable-tanned leather belting.

It is suggested that the scope of the project cover, with respect to vegetable-tanned leather belting:

Raw material
Method of manufacture and construction
Marking
Physical tests
Chemical tests

The Committee recommends that Federal Specifications 37 be given careful consideration as a possible basis of development of American standard specifications for vegetable-tanned leather belting.

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Motion Picture Standards Submitted for Approval

Additional material to the already existing motion picture standards has been submitted to the ASA for approval as American Standard (Z22) by the Society of Motion Picture Engineers. The existing standards cover dimensions for cutting, splicing, and perforating motion picture film and for the apertures, projection lens, diameters, and sprockets of motion picture projectors, and recommended practice in the taking and projection of motion pictures. The new material, for which approval as American Standard is asked, covers chiefly dimensions for the 16 mm home movie film and dimensions for film having a sound track. The Society of Motion Picture Engineers is also formally requesting that it be made proprietary sponsor for motion picture standards. The requests of the Society of Motion Picture Engineers will be submitted to the Standards Council at its meeting of September 11th.

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Standardization Effects Savings

"Before the A.P.I. Standard existed, one of the largest manufacturers of material for the oil fields had to keep on hand 306 templates or gauges for one class of article alone to meet the demands of the multifarious types of equipment he might be called upon to furnish. In their place he now has to keep only 11 A.P.I. gauges, which is a very great saving of expense in maintenance and first cost, as well as in time and labor. What more convincing proof than this could one have of the value of standardization?" From "*True Values in Business and Buying*," a book by C. G. Padel. (B. C. Forbes Publishing Company, New York, N. Y.)

American and European Standardization of Railroad Equipment Effects Savings

Standardization of locomotive boiler parts is effecting savings not only in time lost by locomotives during repairs, but also in labor requirements, and in reduction of motive power requirements, according to an article in the April, 1930, issue of the *Boiler Maker*. Because of the fact that each plate casting or forging is designed complete in every detail, even to the last rivet hole, and that the location of every hole is fixed, each part when assembled fits exactly with those adjacent to it and will serve equally well on any boiler of its class. In the case of replacement parts, particularly those required after years of service, this is especially important. Such sheets or parts may be fabricated miles from the locomotive and when assembled in position will fit exactly. Enormous reduction of shopping time for repairs is, of course, the result.

Not only is this problem of boiler repairs being overcome in the United States, but England is also considering the situation from the standpoint of standardization, according to an article in the *Times Trade Supplement:*

> "This system has been extended to cover even such large items as boilers, and if an engine is stopped requiring extensive boiler work, this part is simply taken out and replaced by another of the same type standing ready. With such procedure it follows that either standardization must have been carried to a considerable length, or the stock of spare boilers will necessarily tie up a large capital sum. If standardization has not extended far, and it is recognized that capital must not be locked up in this way, the time under repairs must become extended. It is the nice balancing of these factors which adds much interest to locomotive work, and with the large amount of data available regarding repairs to be expected, life and relative costs, such matters can be worked out in railway service in great detail. . . ."

English Roads Save £6,000,000

Progress is being made in Great Britain in a larger program of railroad standardization as well. According to an article in the January 25, 1930, issue of the *Times Trade Supplement*, London, economies effected by the railroads through standardization amounted to about £6,000,000 in 1928, which was maintained in 1929 as well. Four groups of railroads are now operating in Great Britain in place of the 120 different undertakings which existed seven years ago. Committees have been set up by these groups to standardize the railway stock of the country. According to the article in the *Times Trade Supplement:*

> "Where it has not been possible to secure a common standard for all the companies each has adopted its own and group standardization has helped to reduce expenditure. One result of standardization has been that less capital is now locked up in spare parts. A large number of spare parts can now be ordered at a time, while interchangeability of parts has reduced the time rolling stock is out of commission for repairs.
>
> "The standardization of locomotives has meant an immense saving. On amalgamation each group found itself in possession of a large number of antiquated engines, and some of these were expensive to run. There are now comparatively few different types. One company had no fewer than 60 different types of wagons and these have now been reduced to 23."

In Germany, the locomotive industry organized its own technical standardization committee (the General Locomotive Standards Committee) in 1927. In cooperation with the Railway Administration and the Industrial Standardization Committee, this committee has undertaken work on the standardization of locomotive parts for all gages and for all locomotives.

Good Management Requires Standardization

The importance of standardization to progress in industrial management was stressed by a report of the Management Division of the American Society of Mechanical Engineers

printed in the January, 1930, issue of *Mechanical Engineering*.

The report says in part:

"With few exceptions, industrial executives are in favor of such dimensional standards as will permit mass production and of quality specifications for the materials purchased by them. The more progressive of the executives are in favor of service or performance specifications for goods sold by them and their competitors, although not a few of them are opposed to 'composition specifications,' which are looked upon by them as tending to retard improvements.

"To the extent that standardization does in fact retard improvement it is disadvantageous; to the extent that it eliminates the less desirable in favor of the better commodity it is advantageous. At an ever-increasing rate, industrial executives are realizing that, when properly carried out, standardization simultaneously eliminates the unworthy and identifies and sets forth the best, not as a finality, but as a starting point for improvement."

Interchange of Ideas Valuable

"Reasonable specifications formulated after thorough interchange of ideas and experiences of the manufacturer and the user and setting forth those requirements considered essential to safeguard the consumer without hardship to the manufacturer, serve to show to both parties to the contract what service the commodity must render, and how it must be manufactured in order to fit it for use. It is to the best interest of all persons concerned that the specifications be formulated jointly by both parties to the contract, working together harmoniously, each benefiting from the knowledge and experience of the other....

"Management is vitally affected by nationally recognized grades, by standards of quality....

"The enlarged export business of the United States and the rapidly growing use abroad of simplification and standardization has brought a demand for further cooperation in the translation of American standards and specifications into foreign languages for the convenience of foreign consumers. Service of supply, including transportation facilities and means of communication, has advanced to the point where buyers no longer shop exclusively in the nearest market....

"The great competition today is between industries, and it is natural, therefore, if members of a given industry desire to maintain the standing of the industry as a whole and a recognized standard for their product, they should set up a minimum level for their commodity below which quality shall not be allowed to fall, in order that the public may buy with assurance and confidence, and that the commodity as a whole shall retain the good-will and command the respect of the purchaser."

Tests May Make Specifications Costly on Small Orders

Because of the cost involved in sampling and testing paints purchased on the basis of specifications it may be unwise to use specifications when only small quantities are ordered, according to P. H. Walker of the Bureau of Standards. To cut down the cost involved in the proper use of specifications, Mr. Walker urges that simple tests be made by the purchaser so that if a paint does not meet these tests it can be rejected at once without being sent to the laboratory for the tests which must be made by a trained technologist. The following quotation concerning Mr. Walker's statement is from *Architecture and Building* for May, 1930:

"At a recent meeting of the public utilities group of the National Association of Purchasing Agents, P. H. Walker, chief of the paint, varnish, and bituminous materials section of the Bureau of Standards, called attention to the fact that purchasing under specifications involves sampling and testing which must be paid for. In his opinion, it is unwise to use specifications except on large orders.

"Specifications for paint materials when properly written contain many simple requirements and tests that can be made as well, if not better, by a competent painter than by a testing laboratory. Users of specification materials should read and understand at least all the simple requirements and tests. When, as is frequently the case, the user can by his own test assure himself that the material is not in accordance with the specifications, he should reject without further test. Only when the user finds that the material meets the simple and easily determined requirements should he send the material to a laboratory for making the less simple tests. In any case, before accepting the material he should make sure it does meet all the requirements of the specifications."